

October 1997

Mobile Radio Technology

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- Repeaters for PCS
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features

10 Total protection is the key to reliability

Joe Jones

Access control, power protection, climate control and remote monitoring are all factors in protecting the investment of constructing a new transmitter and base station site. Preventative maintenance is also a key.

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M.R.J. Bayly, C.Eng., M.I.E.E.

Linear modulation technology provides a platform for analog or digital operations and suits public safety voice or data applications at 220MHz. The possibilities make auction participation attractive.

26 PCS rural model: Cost-effectiveness, coverage and clarity

David Bolan

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31 Paging concentrator boosts profits for paging resellers

Bailey Zheng

Using TNPP networking and a paging concentrator, resellers can maintain their own systems and trunks, allowing additional revenue from sub-agents and the providing of voice mail services.

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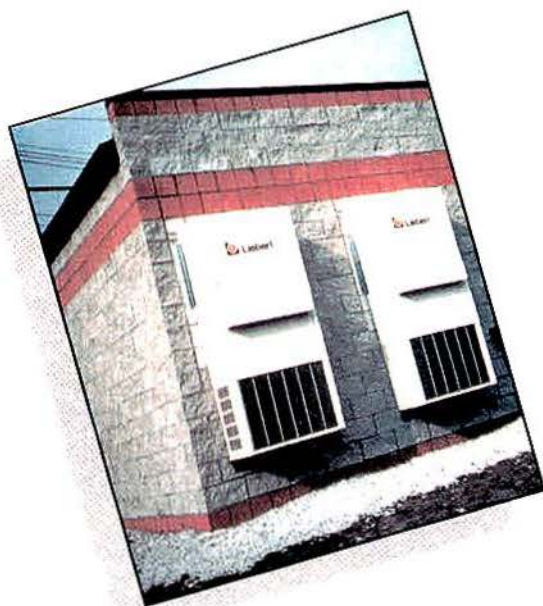
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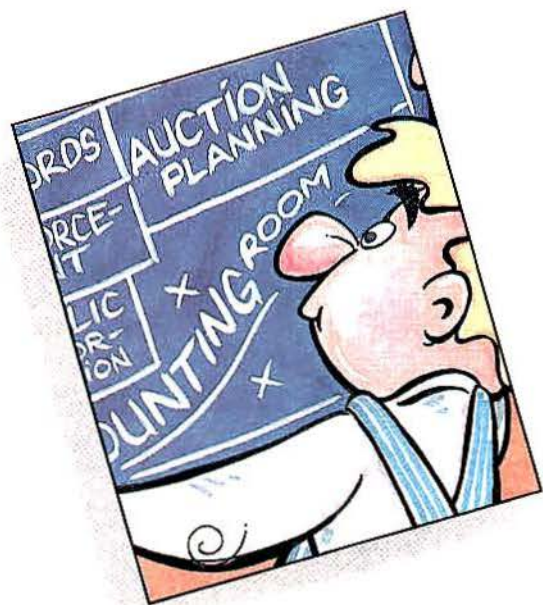
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On the cover: Communications site construction includes total protection for your investment. See Joe Jones' story on page 10. *Design by Michael Knust; photos by D.A. Keckler.*

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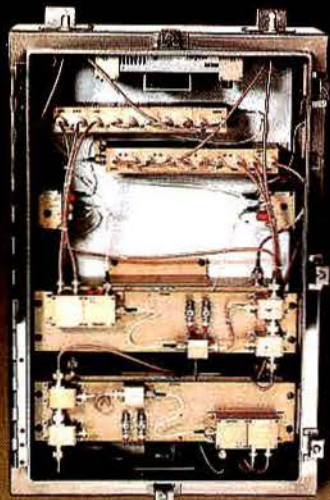
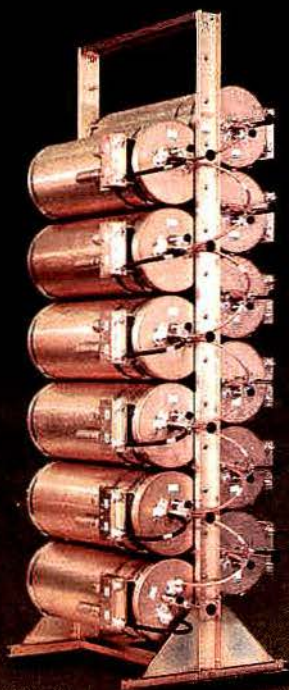
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Scanning . . .



What's in a name?

The Association of Communications Technicians (ACT) is changing its name to the Alliance of Wireless Communications Engineers and Technicians (AWCET), and the Mobile Wireless Communications Alliance (MWCA) is the name selected for the group formed by the merger of the Association of Wireless System Integrators (AWSI) and the Specialized Mobile Radio Alliance (SMRA). Whew!

All of these groups are membership sections of the Personal Communications Industry Association (PCIA), Alexandria, VA, by the way.

PCIA deserves credit for sustaining AWCET as a trade group for technical types involved with, okay, wireless communications. As I remember it, the group began as part of another organization, the National Association of Business and Educational Radio (NABER), which has since merged into PCIA. NABER formed ACT at about the same time that it responded to an FCC initiative to virtually discontinue technician licensing. NABER gave tests and issued certificates to technicians who passed them. The technicians mostly were employed by two-way radio dealerships, large private radio system operators and specialized mobile radio (SMR) system operators. Once certified, the technicians were encouraged to join ACT, and more than 2,000 of them did.

ACT became the largest membership section within NABER, but perhaps the least influential, and maybe the smallest source of revenue compared to the other sections and to frequency coordination.

Times have changed. PCIA represents, well, name the buzz-word: wireless messaging systems, wireless telephone sys-

tems and wireless radio systems (honest!). They used to be called paging, mobile phone and two-way radio, but the old names don't fit well anymore.

So it is with the requirements for technical expertise. Technicians are needed, yes, but so are engineers; the distinctions include education, experience and sometimes state certification, as with a registered professional engineer. The name change reflects an organization prepared to embrace technical types with a wider range of backgrounds and skills than previously may have been the case, although the services already offered under the previous name can benefit many engineers.

The significance of the merger of AWSI and SMRA into MWCA might be a little less clear, although perhaps the continuing consolidation among dealerships ("wireless system integrators") and among SMR system operators ("work-group wireless," don't you know) might be part of the reason. At one time, the interests of dealers and SMR operators were seen to be divergent enough to need separate representation. Now they aren't, apparently.

There's more competition for membership, too. The American Mobile Telecommunications Association (which, years ago, was called the American SMR Network Association) competes for SMR members. Small Business in Telecommunications (SBT) welcomes SMR operators, dealers and paging system operators, among others. As long as they're small, SBT sees their interests as running in common. Then there's the SMR WON trade group of SMR operators, too.

So maybe the AWSI-SMRA merger is a natural progression. If it results in more spectrum for private wireless and for work-group wireless, we'll call it a winner.

* * *

Changes at APCO

If garnering a spectrum allocation, not to mention dodging auctions, is the measurement of a winning trade association, then the Association of Public-Safety

Communications Officials—International (APCO) has to be toting a trophy. APCO led efforts to obtain more spectrum, and now public safety radio communications services seem set to receive about 24MHz of spectrum, someday, eventually, in a reallocation from TV broadcasting. (It's almost certain, isn't it? Congress says so, and that's pretty reliable.)

Along with the promise of more spectrum, APCO, together with its federal and state partners, seems to have resolved its process to set standards for digital radio in Project 25. The results were announced at the national convention in Charlotte, NC, in August.

Why, then, with these apparent successes, did APCO Executive Director Ronnie Rand resign, as of the last day of the convention? The announcement was made by APCO's incoming elected president sort of offhandedly at the end of the banquet. Rand didn't speak to the assembled membership. He wasn't asked to, from the podium. Not to say he wasn't asked beforehand. Maybe he said he didn't want to, and that's why he wasn't asked to when the announcement was made. Whatever the case, it seemed odd.

Rand later told one of our editors that the parting was amicable and that he hasn't settled his plans for post-APCO. He did say that he is leaving the association in a stronger financial condition than it was in when he became executive director several years ago. The APCO office didn't offer any details about the transition.

APCO is one of the "Big Three" trade associations in this industry, and its agenda and policies are important. It would be newsworthy if there were a genuine disagreement between the board of officers and the executive director regarding the association's agenda or policies. After all, Rand was selected by a board of officers long since gone. Maybe the current board just wanted someone else. It's happened before.

The accomplishments on Rand's watch have been important. Maybe that's all that's going to be said.

—Don Bishop

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1997

October

- 6-8—Industrial Telecommunications Association, Annual Conference and Membership Meeting**, ANA Hotel, Washington, DC. Contact: Karin Norton, 703-528-5115.
- 27-29—Wireless Apps**, sponsored by the Cellular Telecommunications Industry Association, Seattle Convention Center, Seattle. Contact: Francesca Dea, 702-739-4025, or Tim Ayers, 202-736-3203.
- 27-28—Small Business in Telecommunications Legislative Forum**, Sheraton Washington, Washington, DC. Contact: 202-736-3203.

November

- 6-7—AMTEX**, sponsored by the American Mobile Telecommunications Association, Hilton at Walt Disney World Village, Orlando, FL. Contact: 202-331-7773.
- 6-8—Second International Congress on Commercial Trunked Radio**, sponsored by the International Mobile Telecommunications Association, Hilton at Walt Disney World Village, Orlando, FL. Contact: 202-331-7773.
- 12-16—Communications Marketing Conference**, sponsored by the Communications Marketing Association, Holiday Inn International Drive Resort, Orlando, FL. Contact: Bernie Brownson, 303-371-8182.
- 21—Radio Club of America**, Communications Symposium, 88th Anniversary Dinner and Awards Presentation, New York Athletic Club, New York. Contact: Gerri Hopkins, 908-842-5070.

1998

February

- 23-25—Wireless**, sponsored by the Cellular Telecommunications Industry Association, Georgia World Congress Center, Atlanta. Contact: 212-964-7000.

March

- 1-4—ENTELEC**, sponsored by the Energy Telecommunications and Electrical Association, Marriott River Center, San Antonio, TX. Contact: 281-357-8700.

April

- 20-23—Expo Comm/Comdex**, sponsored by E.J. Krause & Associates, McCormick Place, Chicago. Contact: 301-493-5500.
- 22-24—International Wireless Communications Expo**, co-sponsored by *Mobile Radio Technology*, Las Vegas Convention Center, Las Vegas. Contact: 800-288-8606.

May

- 18-21—Supercomm**, sponsored by USTA and TIA, Atlanta. Contact: 202-326-7300.
- 18-21—Vehicular Technology Conference**, sponsored by IEEE Vehicular Technology Society, Westin Hotel, Ottawa, Canada. Contact: 908-562-3870.

June

- 20-22—Canadian Wireless**, sponsored by the Canadian Wireless Telecommunications Association, Metro Toronto Convention Center, Toronto, Canada. Contact: 613-233-4888, ext. 102.
- 28-July 2—UTC National Conference & Exhibition**, sponsored by UTC, The Telecommunications Association, Hynes Convention Center, Boston. Contact: 202-872-0030.

October

- 14-16—TelecomLatina**, co-sponsored by *Mobile Radio Technology*, Miami Beach Convention Center, Miami. Contact: 1-800-288-8606.



Mobile Radio Technology

Technical information for paging, SMR and private wireless networks

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RF transmission line tips

By Harold Kinley, C.E.T.

There are a few techniques that all technicians should know in order to work and deal with RF transmission lines more effectively. Some myths have been perpetuated over the years. Some are taken as fact without question. The following tips should help to clear up some of the murky water surrounding RF transmission lines.

Trim the coax!

I remember, back during the heyday of CB radios, hearing some of the "experts" on CB telling their friends how to reduce the VSWR on their rig. Almost invariably the advice was "Trim the coax!" Seldom did I hear "Tune the antenna!" If the antenna is properly tuned it will present a 50Ω impedance to the transmission line. If the transmission has the proper 50Ω characteristic impedance, the length of the line will not matter as long as the antenna is properly tuned.

Non-resonant lines

A transmission line is *non-resonant* when it is *terminated in an impedance that is equal to the characteristic impedance of the line*. Changing the length of non-resonant transmission lines does not change the impedance at the input. It can be 50 feet or 100 feet, but the input impedance will remain unchanged. The only degrading factor will be the loss of the line as the length increases.

Resonant lines

When a transmission line is terminated by an impedance that is *not* equal to the characteristic impedance of the line, it is said to be *resonant*. The length of a resonant transmission line is critical. *Changing the length of the line will change the impedance of the line*, looking from the source. When an antenna impedance is other than the characteristic impedance of the transmission line, the line length can be adjusted to present a better matching impedance at the output of the transmitter.

Line length vs. impedance

This discussion assumes a 50Ω system impedance and thus the use of 50Ω transmission line—that is, transmission line with a characteristic impedance of 50Ω.

In Figure 1 above, a transmission line is terminated into a 50Ω load. The impedance 1/8λ from the load is 50Ω. The impedance 1/4λ from the load is 50Ω. The impedance 3/8λ from the load is 50Ω. The

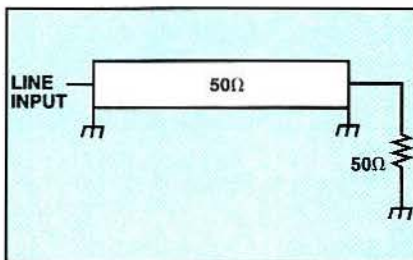


Figure 1. A transmission line terminated into a load equal to the characteristic impedance of the line—50Ω. The impedance will be the same at all points along the line.

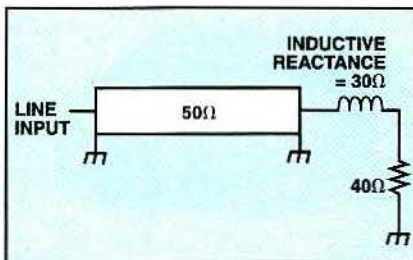


Figure 2. A 50Ω transmission line terminated by a load with the complex impedance of 40 + j30. The impedance will vary along the length of the line and will repeat at every 1/2λ.

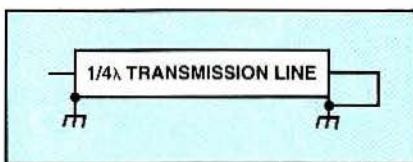


Figure 3. A 1/4λ transmission line shorted on one end produces an open circuit on the other end.

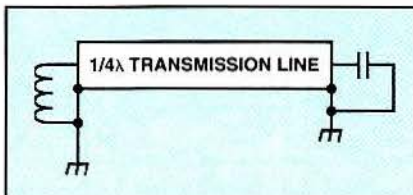


Figure 4. A 1/4λ transmission line can be used to transform an inductive reactance at one end of the line into a capacitive reactance at the other end of the line.

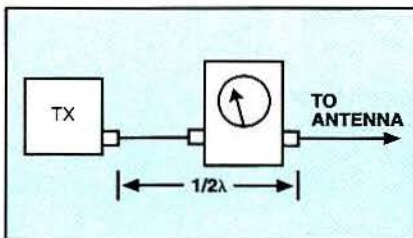


Figure 5. If a transmitter must be tuned into a resonant line, be sure to use a 1/2λ cable (including wattmeter section). Include velocity factor in cable length calculations.

impedance 1/2λ from the load is 50Ω.

Thus, the impedance anywhere along the length of a transmission line will remain the same as long as the line is terminated into a load equal to its characteristic impedance. To further qualify this statement, the load must be a *purely resistive load* equal to the characteristic impedance of the line. This means that the load must not contain a reactive component. Written in complex form, the load must be equal to $50 \pm j0$.

To illustrate the preceding point, the formula for impedance is:

$$Z = \sqrt{R^2 + X^2}$$

Now, if the load impedance in the complex form is $40 + j30$, then the resultant impedance is 50Ω. (See Figure 2 at the left.) However, because a reactive component is in the load, a mismatch will result. The actual VSWR at the load will be 2:1. The same VSWR will be seen at all points along the transmission line, assuming a lossless line. However, the actual impedance along the line will vary, and will repeat every 1/2λ.

At a distance of 1/8λ from the load, the impedance is $100 \pm j0$. At 1/4λ, the impedance is $40 - j30$. At 3/8λ, the impedance is $25 \pm j0$. And, again, at 1/2λ, the impedance repeats the load impedance— $40 + j30$. The cycle repeats every 1/2λ on the line moving away from the load and toward the generator.

Impedance transformation

From the preceding information, it follows that a transmission line can be used to transform impedance. In fact, a 1/4λ line can transform an open circuit at one end into a short circuit at the other end. Or, it can transform a pure inductive reactance into a pure capacitive reactance. (See Figures 3 and 4 at the left.) Open or shorted stubs are used to match impedances using the Smith chart. (Smith is a registered trademark of Analog Instruments, P.O. Box 808, New Providence, NJ 07974.)

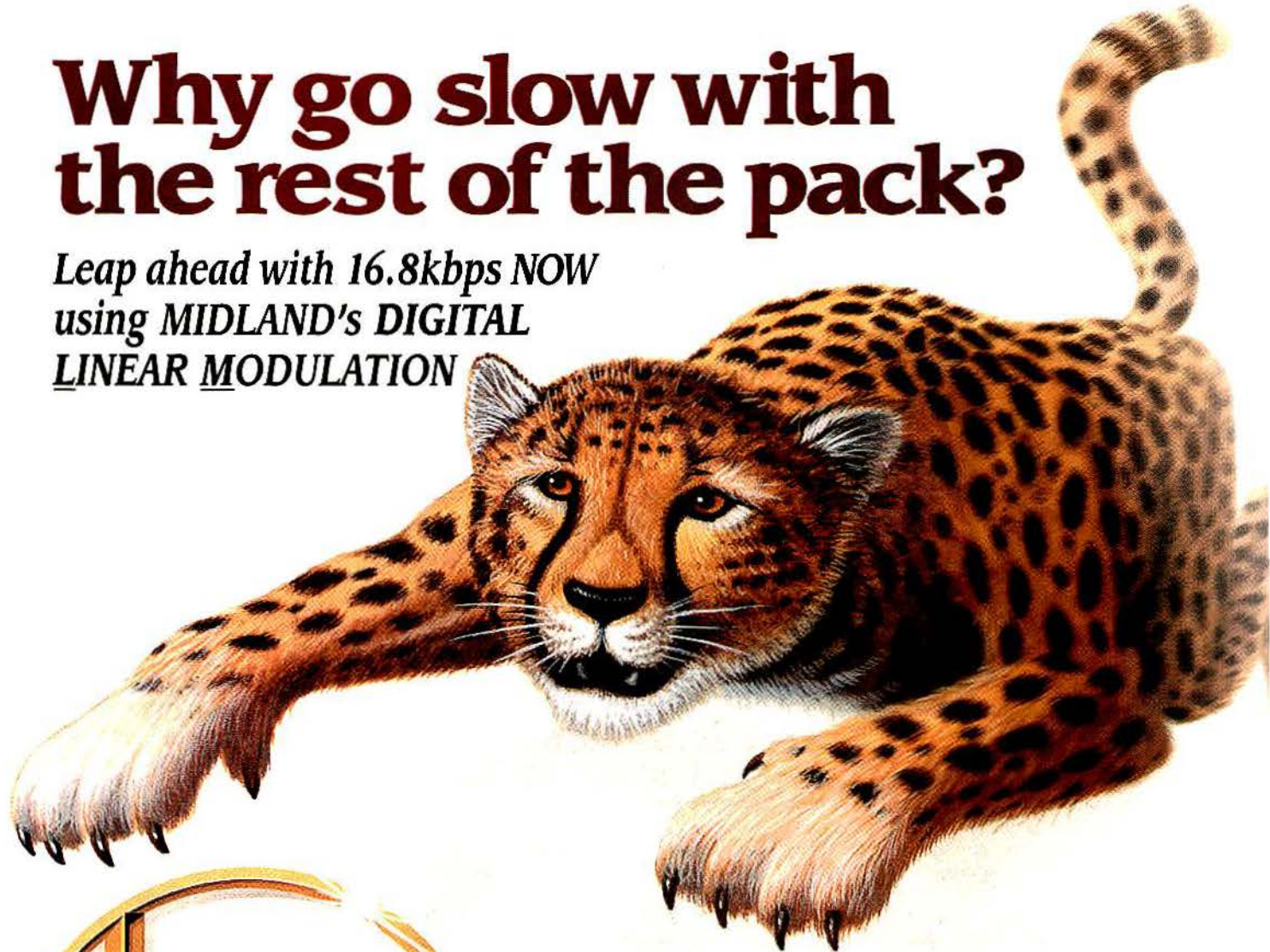
Normally, any mismatch at the antenna

(continued on page 33)

Kinley, a certified electronics technician, is regional communications manager, South Carolina Forestry Commission, Spartanburg, SC. He is a member of the Radio Club of America. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*, which is available for direct purchase. Write to 204 Tanglewyde Drive, Spartanburg, SC 29301. Kinley's email address is hkinley@aol.com.

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Total protection is the key to reliability

Access control, power protection, climate control and remote monitoring are all factors in protecting the investment of constructing a new transmitter and base station site. Preventative maintenance is also a key.

By Joe Jones

When building a new transmitter and base station, consider all factors affecting the site's long-term reliability. Access control, power protection, precision air conditioning and remote monitoring each play an important role in protecting the site from a variety of problems, and together they provide total protection. This total protection package goes a long way in ensuring the availability of mission-critical equipment by protecting it from heat, unbalanced humidity, electrical surges and spikes, and other problems that can bring down the entire system.

Access control

Electronic access control systems have replaced the lock and key with a variety of input media and input devices. In many systems, approved employees are issued a special card or some other form of input medium. When an approved user requests access to an area, the input device for that door relays the information from the medium to some form of decision-making component on the secure side of the door. If the user is cleared to enter that area, the decision-making component sends a signal, releasing the door's electromagnet lock.

The most common access control systems use various input technologies:

- ❑ Magnetic stripe card readers are equipped with a magnetic channel through which a card with a magnetic stripe is passed. Some readers also include a keypad, which requires anyone seeking entry to punch in a personal identification number.

- ❑ Wiegand card readers are designed to react to a series of processed wires implanted in each card. The advantages of these input devices are that they are



Computer-based, on-site access control systems benefit facilities that must be accessible all of the time.

secure, easy to use, weatherproof and vandal-proof. They are often a good option for outdoor areas that require security.

- ❑ Proximity cards verify the eligibility of a user by reading card data from the user's card when it is placed near the reader. The advantage of these readers is that they allow hands-free operation because they can receive signals from several inches away. The card never touches the reader, so abrasion and wear are not a problem.

- ❑ Biometrics don't use cards. Instead, these devices determine who has valid access by "reading" some unique physical characteristics of the user: fingerprints, hand prints or voice patterns.

Because they operate without constant supervision, computer-based access control systems offer many advantages for facilities that must be accessible 24 hours a day, year-round. They are also easily integrated with other critical operating systems. For example, an on-site access control system Liebert developed can be linked with a site monitoring system to monitor a variety of critical components, such as air conditioning, power distribution, uninterruptible power systems, mainframe chillers, temperature and humidity sensors, water detectors, power monitoring and smoke detectors.

Remote monitoring

Keeping an eye on the transmitter site

is paramount. Many sites are in remote areas, making them difficult and expensive to reach for maintenance and repair. Monitoring the transmitter site protects the network's lifeline—the switching equipment. To ensure system availability, remote monitoring for both power and environmental protection is necessary. Reliability is most important when it comes to selecting equipment.

Today's sites are supported by a wide range of critical equipment and systems, including dc and ac power systems, dc and ac power distribution, batteries, generators, air conditioning units, fire detection and suppression systems, security access points and water detection systems. It should be possible to add any piece of remote equipment, including analog or digital signal, equipment-resident or add-on sensors, to your monitoring system.

What would you do, and how would you even know, if a leak were to develop at an unattended site 70 miles from civilization? Water leaks inside. The spreading pool may contact electrical cables and short vital equipment. Damage can be significant. Or, a fan motor quits. The rising temperature in the switch site goes unnoticed. Damage to the sensitive electronic equipment is imminent.

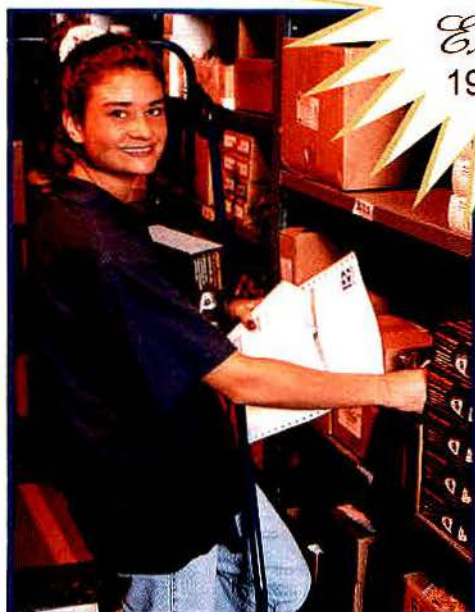
Centralized site monitoring systems are designed to keep managers in control by gathering, prioritizing and reporting information on the performance of all communications equipment and support systems. In addition to monitoring the operating status of a variety of support systems, these monitoring systems allow the operator to control equipment, to modify setpoints and to fine-tune alarm parameters from a distant location.

By using a customer-defined response and escalation plan, the remote monitoring system should instantly detect an alarm, deliver it to operations and provide supporting details to allow employees to quickly understand the critical details of the location and to initiate the

Jones is national sales manager for Liebert's Communication Technology Group, Columbus, OH.



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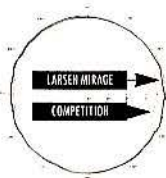
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Precision air conditioning

Reliability, redundancy and standby capacity are important in system design and equipment selection. Equipment should be selected to provide "N+1" reliability. In other words, if a single air conditioner

is selected to carry the load, a second air conditioner must be available as standby. In larger sites, it could be just as acceptable to have a third unit as standby when two units are selected to carry the load.

To address this point, Liebert developed a dual-unit control (DUC) that provides an electrical timer-based control

Effectively managing the construction process

By Brian W. Quinn

replace incorrect parts.

Time management

In the construction process, the ability to manage multiple tasks and to adhere to strict time frames is a required skill. Many "tools" are available that allow you to develop a schedule and to track multiple tasking. Taking the necessary time to prepare these schedules and task lists, as well as reviewing them on a daily basis, will save you much time once the project commences.

Field coordination

Field coordination plays a crucial role from the conception of a site, through design, and during construction. Field coordination molds many individual factors, including on-site investigation, regular review of the RF engineers, requirements to provide coverage, familiarity with the acquisitionist's commitment to the land owner, understanding any stipulations placed on the project during the zoning process, and daily interaction with the general contractor to ensure their work is performed accordingly. If all of these factors are taken into consideration, the site will satisfy the network requirements.

Communication

Many books have been written on communication by experts in their respective fields. With that said, the ability to communicate clearly and succinctly is rare. Never take for granted that you were understood the first time. Repeat critical items several times. Nothing is lost if an extra phone call is made just to be sure that everyone is up to date with the most recent information on a project. In the end, the success of a particular project will rest on your ability, and the ability of your team, to effectively communicate.

During the past year, the amount of time allotted to build a communications site has decreased significantly. To improve coverage and obtain market share, both PCS and cellular carriers are requiring that sites be built quicker and more efficiently.

Many factors contribute to the overall success of the site construction process. However, the key to building a site on time and on budget is how well you proactively manage the process. Five criteria must be met to ensure an organized and efficient buildout of a site.

Prior preparation

Prior preparation is critical. This includes developing detailed drawings, a comprehensive set of standards, a list of acceptable materials, and a thorough scope of work for the general contractor. Prior preparation will prevent delays and reduce, or even eliminate, the need for change orders.

Review materials

Many carriers have employees who are responsible for ordering site electronics, coaxial cable, associated connectors and antennas. However, two people should review each order prior to its placement. Also, a field check at the warehouse should take place as soon as the materials arrive. It is crucial that all items be obtained at least two weeks prior to the start of construction. This will enable you to procure any items that were not delivered or to

Quinn is director of operations-Eastern Region for TynanGroup real estate consulting and wireless site development firm. The company's headquarters is in Santa Barbara, CA. It maintains offices in Boston, Chicago, San Francisco, Cleveland, Detroit, Greenwich, CT, San Luis Obispo, CA, and Fort Lauderdale, FL.



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CS-900 Control Station Interconnect. Has Digital voice delay, Speed-dialer and more. Export version available. Low cost.

CS-800 Duplex interconnect with built-in repeater maker. Speed dialer and more. Low cost.

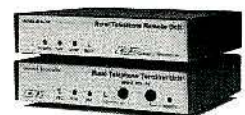
9800 Provides selectable interconnect mode; Control Station, Half Duplex or Sampling. Has built-in Repeater maker; DTMF, CTCSS, 2 Tone, and 5/6 Tone signalling; Speed dialer and more.

RT8 System Allows an ordinary tone/pulse telephone set to operate wireless at a remote location. (RF equipment not included).

CD-2 Decodes and displays; 51 CTCSS, 112 DCS and 16 DTMF's. Has serial port and optional data management software for your PC.

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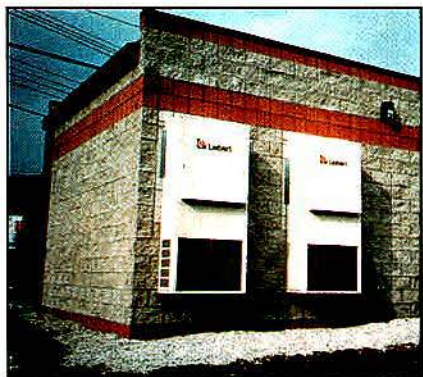
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To ensure protection from heat and humidity, a second air conditioner should be available as a standby.

to switch the operating sequence of two or more air conditioning units on a one-, two-, four- or eight-day basis. The DUC contains a two-stage heat and two-stage cool thermostat with individual heat and cool levers. The thermostat's heat anticipators are adjustable, and the cool anticipators are fixed. LED's indicate "lead unit" and power from unit one or unit two.

Because air conditioners are capital expenditures, they should be constructed for long service life and should include

such items as an aluminum or steel cabinet for the portion of the system installed outdoors, and stainless-steel drain pans for the cooling coils.

Based on the critical nature of these sites and the constant equipment load, air conditioners should be selected with reliable and energy-efficient components, such as scroll compressors and expansion valves or capillary tubes for precise refrigerant control. Because cooling is required on an almost constant basis, the system must be capable of cooling in outdoor ambient temperatures as high as 120°F and as low as -20°F. It is important not to cut corners when selecting the equipment that is responsible for maintaining temperature control on a continual basis. Finally, the air conditioner should be specifically "designed for" communications applications, not "adapted to" communications applications.

Humidity control must be taken into consideration when protecting digital switching systems, also. Digital switches represent multimillion dollar investments for local exchange carriers that provide local telephone and data services, as well

as long distance and voice mail. Humidity regulation is important at telephone central offices because of the sophisticated electronic circuit cards at the heart of the switching operation. Humidity must be maintained at around 50% to reduce static electricity.

A Kenton, OH, facility for Alltel Ohio has been under environmental control since the installation of the digital switching system in the early 1980s. The company just replaced two older models with a single 15-ton System/3 environmental control unit. Because of the heat given off by the switching equipment, the unit is in a cooling mode all year long.

Power protection

Today's electronic devices are sensitive to environmental conditions, particularly the quality of the incoming power. Minor power fluctuations can stop today's telecommunications switching devices from delivering optimal availability. The grounding system is the fundamental building block of the total protection package. The other elements rely on it and enhance it.

A good ground system is imperative

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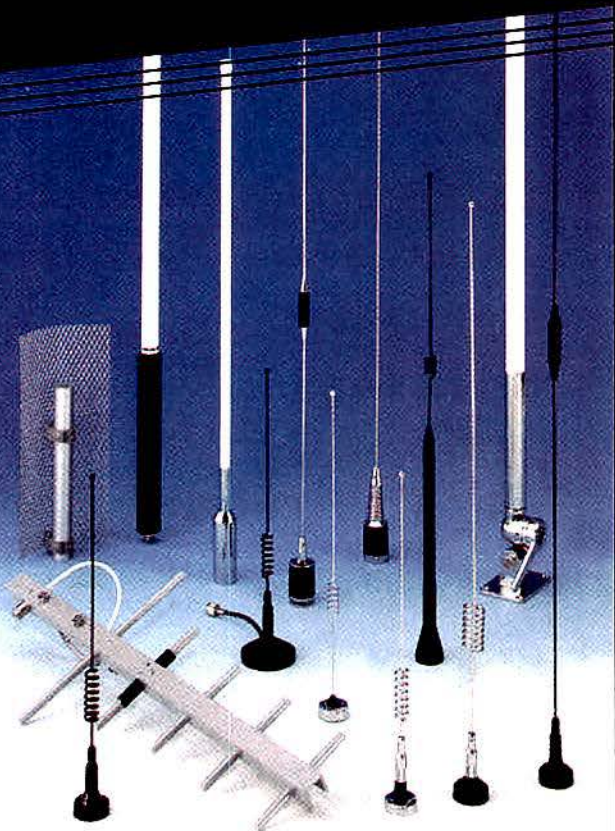
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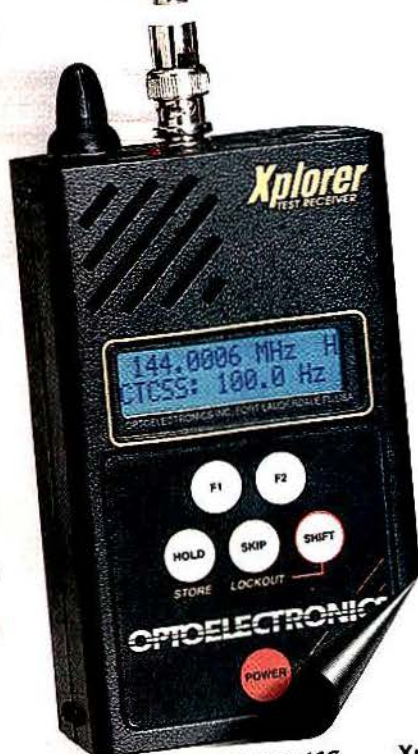
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Patent No. 5,471,408

FEATURES

- Nearfield receiver, sweeps **30MHz-2GHz** in <1 second
- Decodes **CTCSS**, **DCS**, and **DTMF**. Manually record tones into memory
- Lockout up to 1000 frequencies
- Store **500 frequencies** in **memory** with time & date stamp, as well as number of hits per frequency
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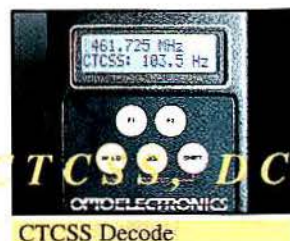


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Input 50 Ohm	-59dBm @100MHz -25dBm @1GHz
Display	2 line LCD
Power	Internal NiCad



CTCSS Decode



DCS Decode



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for proper protection and equipment performance. Ground systems are designed to prevent personal injury, to protect communications equipment and to reduce noise on the circuits.

Communications systems need protection from lightning, utility fault conditions and short circuit occurrences. Surge protectors located at building entrances are called telecommunications *protectors* or *station protectors*, and

surge protectors deployed within the building or terminal equipment are called *secondary protectors*. Surge protectors for telecommunication circuits should be listed under UL 497-1997 or UL 497A-1990. The chosen surge protector should be designed and tested for the intended type of telecommunication circuit.

Preventive maintenance testing, service
A well-administered testing program

can prevent accidents, save lives, minimize costly breakdowns and reduce unplanned outages. An effective electrical maintenance program is one that enhances safety and reduces the probability of equipment failure. It is important to base the program on the fundamental idea that maintenance cannot be performed once and then forgotten.

Maintenance testing and repair is usually performed by a specialized electrical testing company. It should use state-of-the-art test equipment to ensure the accuracy of the test results. All equipment used should be in calibration and traceable to the National Institute of Standards and Technology.

A well-administered testing program can prevent accidents, save lives, minimize costly breakdowns and reduce unplanned outages.

In arranging for service of your equipment, you should choose a company that provides local experts globally, ready to service all the elements of the total protection package. Service and monitoring should be available to all your sites, 24 hours a day, year round. You should have the convenience of working with one service company without losing control, response time or technical expertise. Look for a company with proper resources, ISO 9001 certification worldwide, factory-trained technicians and expert local representatives that will guarantee when the service people will arrive on site to attend to your problem.

Bringing it all together

By combining access control, remote monitoring, precision air conditioning, power protection and service to each site, the overall network will be protected from many common problems that often lead to outages and downtime. Using one company for all your support needs provides a single source of accountability. The company should provide you with high quality service, tailored to fit your specific situation.



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Technology boosts interest in 220MHz auctions

Linear modulation (LM), a mature voice and data technology, opens up new opportunities for SMRs, utilities and public-safety agencies at 220MHz. The possibilities make auction participation attractive.

By M.R.J. Bayly, C.Eng., M.I.E.E.

Auctions are one device employed by the FCC in the race to get spectrum into the hands of operators who will maximize its use. The 2MHz block at 220MHz–222MHz is now targeted for an early 1998 auction. The 220MHz service may be the “new kid on the block,” but LM technology has been to college and has earned its degree.

So, why should you take notice? If you’re an operator, or aspiring to be one, auctions may offer new opportunities. If you’re a user, one of the most efficient wireless technologies available today, 5kHz LM (linear modulation), is bringing new business efficiencies with its high-speed data capability. Although other forms of linear modulation have been used for decades, the form first demonstrated in 1992 and type-accepted by the FCC in 1994 is an example of very narrowband linear modulation (VNBLM).

220MHz vs. other bands

The 220MHz services started years ago as a result of the FCC’s allocating a 2MHz block for “spectrally efficient technologies.” Service for 220MHz has had a tortuous infancy (some even say this has been to its advantage), with uncertain rules and the previous lottery system of assigning licenses that put channels in the hands of speculators rather than operators. Nevertheless, 220MHz services provide considerable advantages over other services. Their operators and suppliers have demonstrated tenacity and are now ready to take these burgeoning services into auctioned spectrum where other services are offering challenging levels for

operators and users alike. The range of 220MHz signals is superior to the higher-frequency signals of 800MHz specialized mobile radio (SMR), cellular and personal communications services (PCS). Fewer sites are needed to provide coverage, which makes the cost of service more attractive for operators because they can offer users a comprehensive package at competitive rates.

Types of operator

Although SMR has been the primary use for 220MHz services so far, there are other possibilities. Public safety already has a number of allocated channels that are not subject to auction and that are available under a mutually exclusive, first-come basis. Any mobile operation needing new spectrum should consider bidding at the 220MHz auctions. Licenses will be available for economic areas

(EAs), regional and nationwide blocks. With nearly 200 channel pairs available, 220MHz is probably more attractive than some of the PCS spectrum. The spectrum winners will also be allowed to *disaggregate* and *partition* their spectrum to enable the greatest flexibility of use. “Disaggregation” means taking some of the channels from the allocated block over the whole licensed geographical area and allowing another operator to use them or selling them outright. “Partitioning” means taking a sub-area within the licensed area and allowing and selling all the channels in that sub-area.

The auction will include both small and large players. Incumbent 800MHz players displaced by the new rule changes could well find the highly spectrum-efficient digital technology at 220MHz to be more attractive than the prospect of continuing with outdated and inefficient

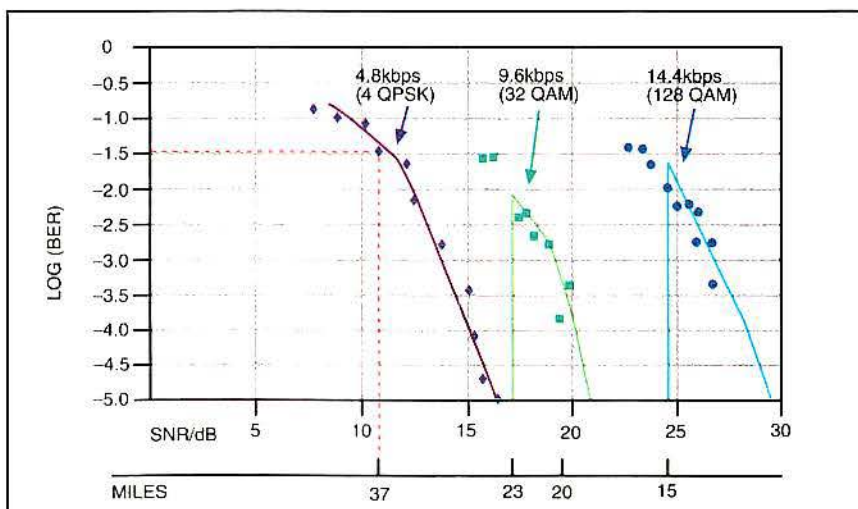


Figure 1. The data protocol uses the fastest possible data rate for the prevailing conditions and maintains a common radio coverage footprint for speech and data. The three plots represent calculated range with a solid line and measured range with plotted points for the three data speed levels. The dotted red line at 37 miles approximates closely the industry standard signal-to-noise level (12dB SINAD) at which speech becomes difficult to understand.

Bayly is LM marketing director for Midland USA, Kansas City, MO.

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systems that are nearing the end of their economic and technological life. The competition for SMR is enhanced specialized mobile radio (ESMR), cellular and PCS. LM 220MHz can provide a service with high-quality voice and high-speed data in a single unit at a competitive end-user cost.

5kHz LM technology

The 5kHz LM technology developed by

Securicor, Bath, Avon, U.K., was described in my article "Technology Update: 5kHz Linear Modulation" in the January 1994 issue. As a result of a merger between Securicor Radiocom, Bath, and Intek Diversified, Princeton, NJ, in late 1996, Securicor took a majority holding in Intek. Midland USA, part of the Intek group of companies, with its nationwide dealer and direct sales operations, now markets the LM 220MHz sys-

tems. As a further result of the merger, Intek now owns the LM technology and intends to market it worldwide.

LM has many advantages over other technologies. It is digital, yet it is also analog. It uses all the benefits of digital without the accompanying disadvantages. One problem with an all-digital system is the *range-edge cutoff*. Unlike analog, where the user can choose whether to listen and to try to decipher the information when the signal gets weak and noisy, a digital system doesn't allow such an option. The user has no choice, because, at the edge of the signal range, the information is indecipherable. In fact it is annoying to try to listen to it. The good news is, there is a solution: the bad news is, it costs! To ensure that a user doesn't experience the reception of weak signals, more sites have to be implemented; a roughly 2:1 ratio is the norm.

So, if a system costs more to install, guess who pays?

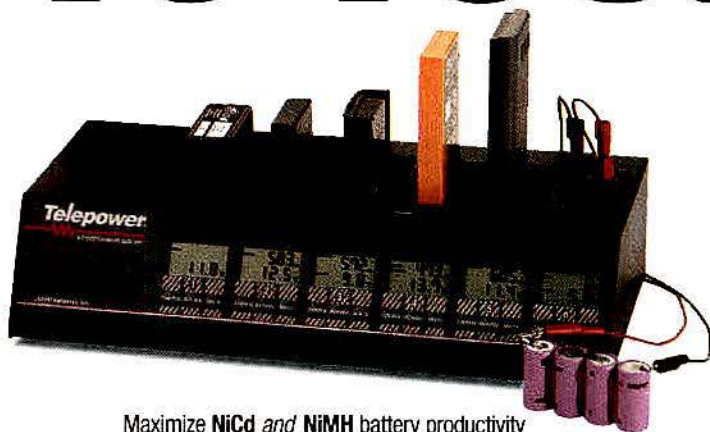
Because LM transmits an analog signal, it doesn't suffer this range-edge

LM has many advantages over other technologies. It is digital, yet it is also analog.

signal cutoff, so the system is more economical to install and to use. LM uses digital signal processing (DSP), but instead of low-rate vocoding, or a higher rate that is time- or code-shared (the effect is the same—reducing the number of bits to represent the coded information signal), it uses a sample rate of 44.1kbps, equivalent to an audio compact disc, to retain the original quality. This sample rate delivers excellent voice quality and recognizability, at least as good as 25kHz FM.

Data performance with LM is equally impressive. Figure 1 on page 18 illustrates the three data speed levels. Currently running a raw, or gross, data rate of 16.8kbps with 128QAM (quadrature amplitude modulation) trellis-coded modulation (in a 5kHz channel), the system uses a dynamic rate modem to interact with the real world of mobile data. No forward-error correction (FEC) is applied to slow the data down unnecessarily. The system senses the path conditions and adjusts the rate accordingly. This means that a

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system can be designed for both voice and data with no difference in the design criteria, and the user gets his data. The data might slow down at the range edge, but the user still gets it. The signal can even be lost for part of the transmission, and the system will fully recover, automatically and with no user intervention. This applies equally to transmissions to a fast-moving vehicle, which is the real world of mobile data (particularly for public

safety use). This performance is achieved by the use of the integral technologies of *reference vector equalization* (RVE) and *feed-forward signal regeneration* (FFSR) where the distortions of amplitude, frequency and phase caused by multipath and Doppler effect are corrected in real time, giving the wireless environment a wire-line performance.

RVE was formerly referred to as transparent tone-in-band (TTIB). Reference

vector equalization is more completely descriptive of the technology, wherein a pilot tone is created and used as a reference for decoding in the receiver. With FFSR, the RVE tone is extracted in the receiver, and the audio baseband is recombined exactly in phase and amplitude. The tone is then used as a reference for canceling the effects of multipath, Rayleigh fading and the Doppler effect.

A number of public safety agencies are looking to SMR operations to provide some of their non-critical communications. The use of SMR operations could solve some of public safety's communications congestion.

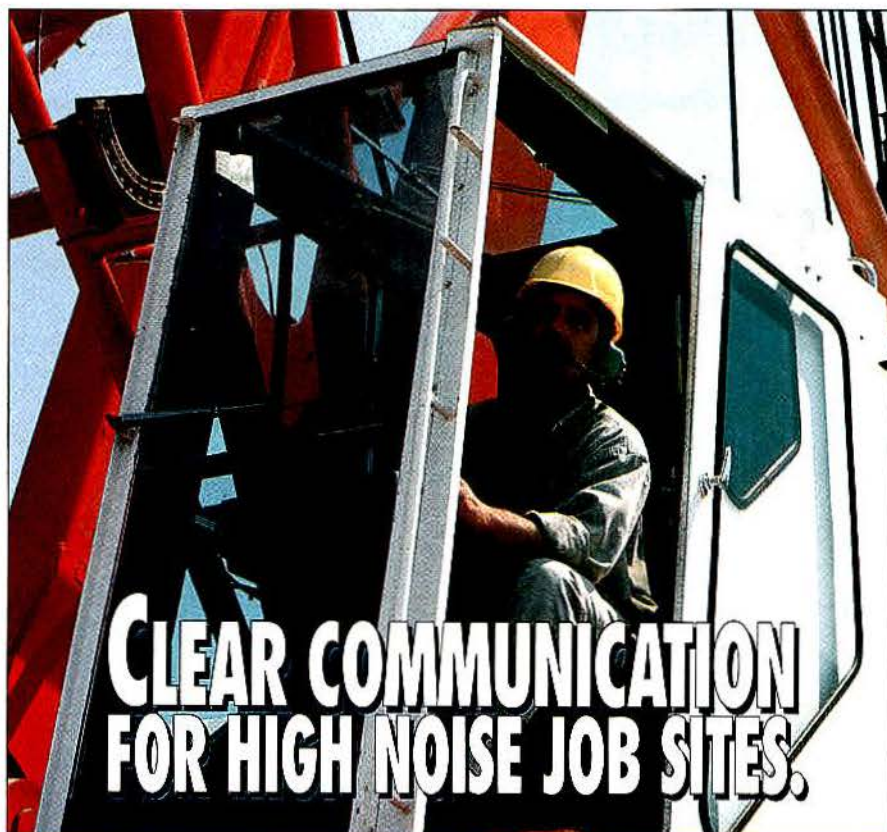
LM, being fully linear, is an ideal platform for future mobile radio technologies, whether they are analog or digital.

New developments: networking

The initial products were for single-site operation, where the majority of the channels in the Phase I channel groups at 220MHz were licensed. The amalgamation of systems to provide wide-area coverage created a need for networking solutions. A new multisite switch and computerized control is now available, allowing for regional operation required for the new Phase II channel groups licensing.

Multisite switching enables a user to roam throughout the entire multisite coverage area and, with no operation of any controls on his subscriber unit, to make and receive calls as if he were operating on a single site in the same way that cellular systems operate. The system logs the site on which a user is registered, so it always knows how to set up a call. Neither the mobile user nor the dispatcher has to have knowledge of which site to use. The system is programmed with many functions to enable the operator of the system to both optimize use and to allow or limit the use of functions and sites. This ability ensures that users get what they pay for, and it allows the system operator to tailor service for the individual, keeping costs down for everyone. Full 24-hour use is recorded in tabular form, allowing graphing that can be used to optimize system design and grade of service.

The soft-failure modes, together with alarm reporting, ensure minimum capacity and service loss under failure conditions, a vitally important consideration for users who make critical use of their mobile communications. Emergency calling is another facility that can be made available. For an extra monthly fee, a user could be given priority access to a channel, even if the whole system is busy.



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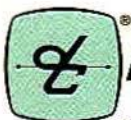
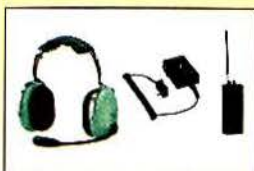
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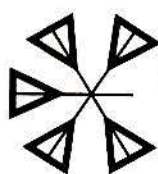
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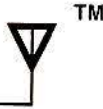


T-1

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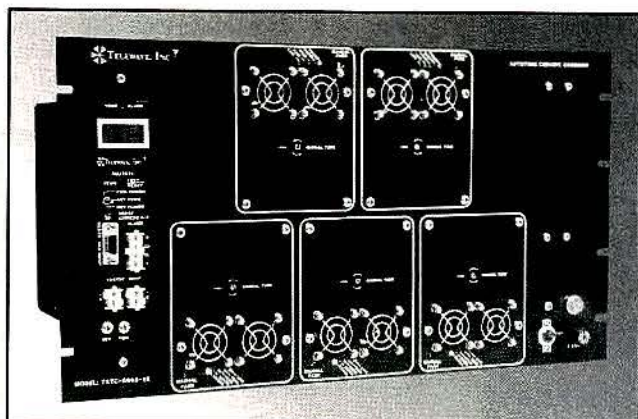


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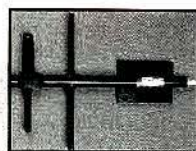
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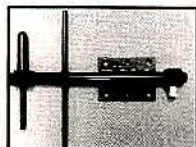
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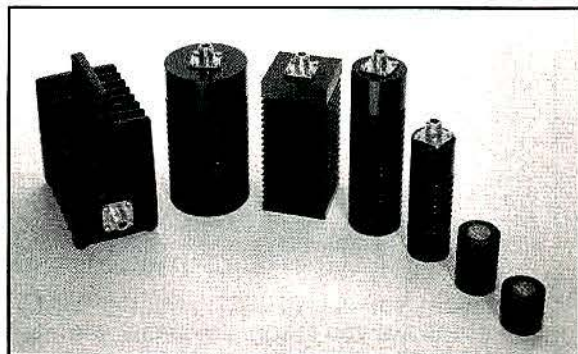
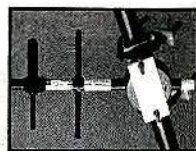
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There normally is a heavy fee to guard against misuse, but at least the priority features could be made available for an operator who wanted to provide that facility.

Because the Phase II 220MHz licensing is issued on a geographic basis rather than a site-specific basis, the networking computer's ability to allocate channels on a "where-and-when" basis ensures optimum use of channel resources. Its modular design keeps initial costs down but allows simple expansion as needed. It is fully compatible with the high-speed data facility, so again, a single system design accommodates both voice and data.

New developments: products

A choice of repeater powers of 25W and 100W enables optimum systems to be designed for wide-area coverage. The current choice of two mobiles and a

*New data applications
are being investigated
that will use the
unique capabilities of
the LM system.*

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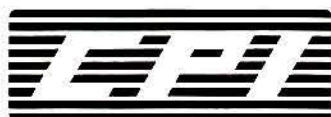
The Alpha series MCR/TSR remotes and MCP/TSP series termination panels allows you to remote control your Kenwood conventional or trunking radio over any two wire voice grade circuit.

The Alpha series remote provides an LCD readout for channel number, up to 99, and a ten character channel name. Controls also include channel up and down, monitor, scan and privacy. All parallel remotes and the radio are updated simultaneously any time a change takes place.

Systems also available for Motorola, Midland and Johnson radios.

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portable will be supplemented by a flexible architecture that enables easy customization of products at the least cost to the provider and user. New data applications are being investigated that will use the unique capabilities of the LM system. Already available are GPS and vehicle data collection systems, high-speed file transfer for direct computer connections and computer-aided dispatch systems with status messaging.

Point-of-purchase credit card authorization, data monitoring and email will enable business users to be connected to their office at least cost. Other possibilities include remote site picture transfer for secure locations. With high-speed data, the applications are almost limitless.

Conclusions

The 2MHz of spectrum at 220MHz-222MHz is the new opportunity for both small and large operators and users. There is a growing choice of subscriber units and data options. With spectrum costs now an important part of the overall cost-of-provision equation, VNBLM is the future of mobile communications.



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PCS rural model: Cost-effectiveness, coverage and clarity

A hybrid of base stations and repeaters may be PCS carriers' answer to filling in coverage gaps at a cost they can justify and afford. In many of these new markets, coverage, not capacity, will determine survival.

By David Bolan

As the cellular and personal communication systems (PCS) industries heat up and competition grows fierce, cost issues are raising important questions. How much do I need to pay for building a network that will ultimately grow my subscriber base? How do we keep the clarity and quality of people's calls a top priority when land issues and alternative coverage applications cost so much money?

Looking for ways to answer these ques-

Bolan is vice president, marketing, for Repeater Technologies, Sunnyvale, CA.

tions has become as much of a preoccupation as paying the bill for the license. As many carriers are beginning to realize, the answer may be in repeaters.

The situation

PCS license holders are currently presented with the reality that PCS is having a hard time living up to its touted benefits. Coverage issues have been at the forefront of the carriers' problems. These problems begin with the need to have three PCS cells to cover the same area that a cellular cell site does. As a result, PCS build-outs have been characterized as having a predominance of "micro-holes." To fill these holes, carriers have to justify the huge costs in areas where less air time is used. They are normally unable to justify it, however, without the subscriber base to support the cost. But without the coverage, they cannot build a solid customer base, which is the "Catch-22." With all of the features and wonders of PCS, ultimately the coverage saturation that most PCS carriers have been able to deploy is simply not enough to satisfy their current and potential consumer bases. In these new markets, coverage, not capacity, will determine the survival of the license holders.

As carriers look toward new solutions to wireless deployment, lower cost architecture alternatives will increase the ability of

*Lower cost
architecture
alternatives will
increase the ability of
the carrier to provide
quality, competitive
digital services—
sooner.*

the carrier to provide quality, competitive digital services—sooner. With an estimated 115 million North American subscribers expected by 2002, or about 8% of the 514 million world subscribers¹, PCS carriers need to recover the time lost in

¹Strategis Group, *World Cellular and PCS Markets: 1997*.

Table 1—Repeater specifications' effect on network performance

	OA1900C	OTHER
Power	6.3W	2W
Diversity	YES	NO
Reverse FER	<1%	>4%
Range	9.45MI	7.9MI
BTS Capacity	100%	<50%
Talk Time	100%	<50%

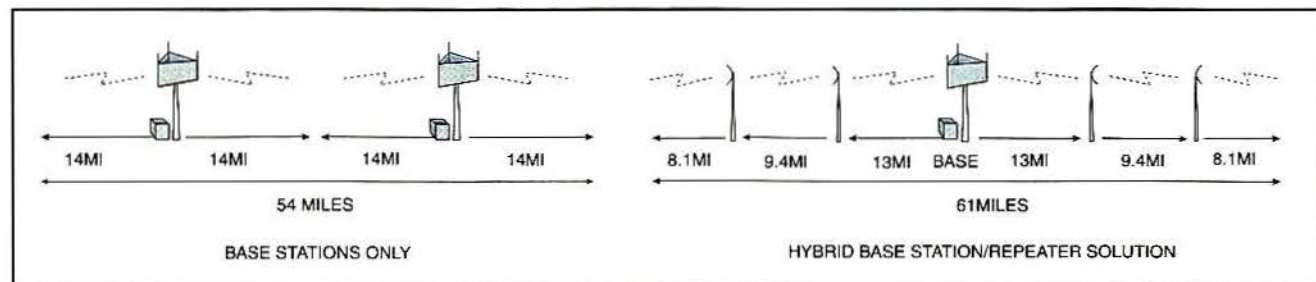


Figure 1. Base station vs. hybrid repeater and base station comparison, using 30° directional antennas; straight highway, flat terrain.

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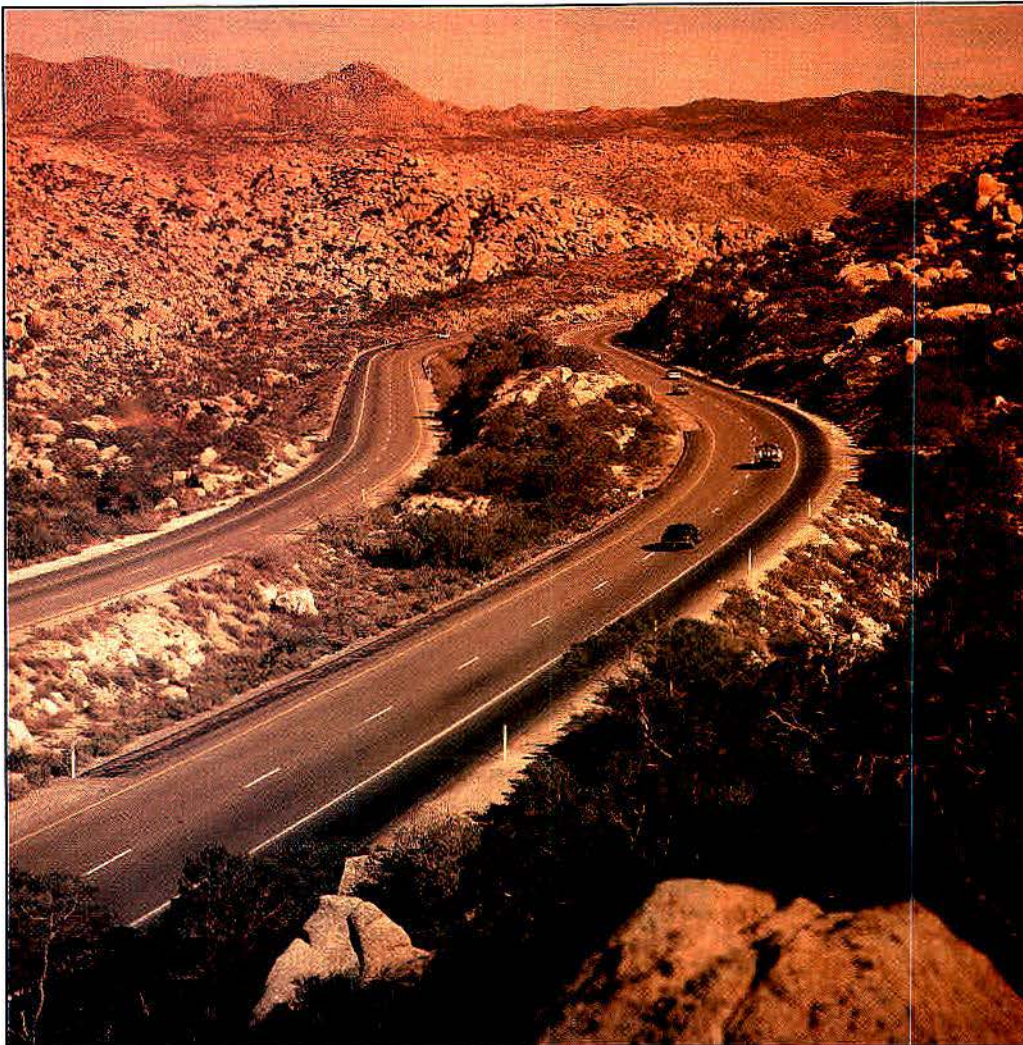
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Rural highways, such as I-5 in California, are exemplary applications for using the hybrid model of repeaters and base stations. Photo by Josh Mitchell.

false starts or lose precious market opportunities by not delivering. The solution to this equation lies in the best use of available capital to create a network that will deliver quality results.

Four applications are currently available to carriers to extend their coverage:

towertop low-noise amplifiers, repeaters, smart antennas and superconducting filters. Each model carries a price tag and, often, features not necessary for the task at hand. One field-proven technology is repeaters. They have consistently offered the market the coverage it needs while

and recurring costs.

The optimal feature of this class of repeater is that it has been designed with receive diversity. Most CDMA channel elements feature a RAKE receiver with "four fingers" that each accept incoming signals. These signals are then processed and combined to boost the gain and improve the clarity of the call. Diversity is directly correlated with the frame error rate (FER). The FER with diversity is reduced to less than 1%. Without receive diversity, call clarity deteriorates to greater than 4% FER. Arguably, the most important benefit of a diversity repeater is talk time. When compared to a repeater element without diversity, a diversity repeater will provide, at a minimum, 100% more talk time for a hand-held, battery-operated subscriber terminal—these phones simply don't need to use as much transmit power to get a quality signal to the repeater antenna.

augmenting networks cost-effectively.

Coverage advantages

It takes about three PCS cells to cover the same area as a cellular cell. The use of microcells to combat this problem has created a situation that leaves carriers with too much wasted capacity, higher operating costs and an unresolved coverage problem.

Repeater Technologies developed a new over-the-air CDMA network repeater, the OA1900C, that extends over-the-air repeater range by as much as 20% in highway applications and by 50% in suburban coverage areas—without sacrificing any of CDMA's generous capacity. As shown in Table 1 on page 26, the repeater bumps power from the 2W output of previous repeaters to a full 6.3W—greater than a threefold increase. (On the logarithmic dBm scale, that jump measures from 33dBm to 38dBm.) In addition, the repeater requires no switch capacity, unlike base station or microcell options. This feature saves carriers money in up-front

Table 2—Base station vs. repeater capital cost.

ITEM	BASE STATION (\$)	REPEATER (\$)
Equipment	350,000	25,000
Installation/Engineering	12,000	4,000
Tower (80'-100')/Antennas	55,000	52,500
Back-up Power	14,000	3,500
Site Acquisition (Raw Land)	25,000	15,000
Equipment Pad	50,000	Not Required
GPS Antennas	1,000	Not Required
Towertop Amps	10,000	Not Required
Switch & T1 DACS Port	33,000	Not Required

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In addition to clarity issues, capacity is the other part of the story. For example, in rural applications without receive diversity, capacity is adversely affected by 50%–80% on a typical rural highway. Diversity does not compromise capacity, and carriers are able to grow their subscriber bases without worrying about replacing systems.

Repeater Technologies has designed remote diagnostic software, and the company has also been working with various carriers to create models of deployment that reflect the capital expenditure concerns (see Table 2 on page 28) and the equally important need to provide a network that has flawless quality and coverage.

Cost advantages: Rural deployment

A recent rural example can be used to illustrate the cost-effectiveness of using a hybrid model of repeaters and base stations. Along Interstate 5, from San Joaquin to Kern County, CA, a hybrid model of repeater and base station was deployed for a 160-mile stretch.

In the hybrid deployment, signals are "cascaded" from the base station to two over-the-air repeaters in each direction. (See Figure 1 on page 26). The hybrid

configuration, one base station—four repeaters, was able to cover 61 miles compared to 56 miles for two full base stations on this flat and straight road.

Over the full 160-mile stretch of highway, the base station-only build-out (10 base stations) would run \$5.5 million in capital costs alone. On the other hand, the hybrid deployment (four base stations and 14 repeaters) would cost only \$3.6 million—a capital savings of \$1.9 million, with another \$1.3 million in savings over five

years for recurring costs. (See Table 3 above.)

Conclusion

In the race to beat the critics, PCS carriers need to work with what they have: technology and limited financial resources for deployment. PCS carriers can move forward and build networks and, as a result, strong subscriber bases—build it with repeaters—and they will come.



Table 3—Base station vs. monthly recurring costs.

ITEM	BASE STATION (\$)	REPEATER (\$)
Real Estate Lease	1,000	500
Electricity	430	20
Hardware Maintenance	150	50
Software Maintenance	20	5
T1 Backhaul (75MI)	2,000	25
Diversity Backhaul	2,000	Not Required
Total	5,600	600
NPV @ 6%		
1 year	65,066	6,971
5 years	289,663	31,065

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Paging concentrator boosts profits for paging resellers

Using TNPP networking and a paging concentrator, resellers can maintain their own systems and trunks, allowing additional revenue from subagents and the providing of voice mail services.

By Bailey Zheng

With the rapid development in wireless communications, the paging industry is experiencing quick growth. At the same time, competition is on the rise and profits to resellers are going down. A paging and voice mail concentrator can provide a solution for those looking to increase

profits and to lower monthly costs. It also provides the additional bonus of voice mail at no extra cost.

In the traditional arrangement as shown in Figure 1 below, the paging reseller acts as a broker for the paging carrier. The end user purchases a pager from the reseller. The reseller activates the user's number on the carrier's system by dialing into either the carrier's paging terminal or the

carrier's billing system. When the user sends a page, the phone call gets connected to the telephone trunk on the carrier's paging terminal. The terminal gets input from the user and sends the page from the terminal through the transmitter controller to the transmitters.

With Telocator Network Paging Protocol (TNPP) networking as shown in Figure 2 at the bottom left, the reseller becomes a "virtual" carrier by having a paging and voice mail concentrator with the reseller's own telephone numbers. The concentrator is located at the reseller's location and is TNPP-networked to the carrier's terminal over a leased phone line. The reseller sells pagers to the end user and activates the pager phone number on its concentrator. When the user sends a page, the phone call gets connected to the concentrator. The concentrator collects the page and sends it to the carrier's terminal over the TNPP link. Once the carrier's terminal receives the TNPP package, it in turn forwards the data to the transmitters.

TNPP networking gives resellers total control over their customers. Because resellers maintain their own systems and telephone trunks, the carrier is only providing the page transmission. Therefore, it is not unusual for a carrier to reduce its air time rate by 50%. By using a paging concentrator, the reseller can gain two additional sources of revenue: subagents and providing voice mail. Because the reseller can purchase air time for less, air time can be resold to smaller agents at a profit. With an integrated voice mail in the paging concentrator, the reseller can provide voice mail without having to pay the carrier.

For example, assume that a reseller is currently paying \$3 per month for air time and voice mail. With as few as 1,000 customers, the monthly savings is about \$1,500. With the additional revenue from

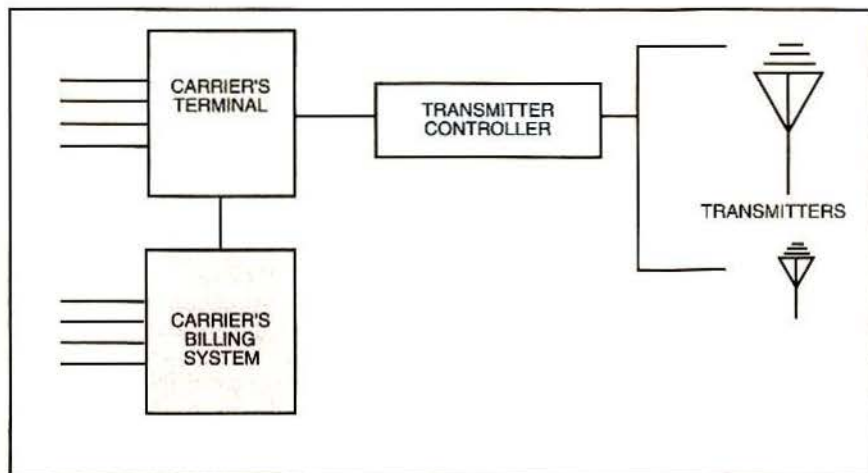


Figure 1. Traditional paging process.

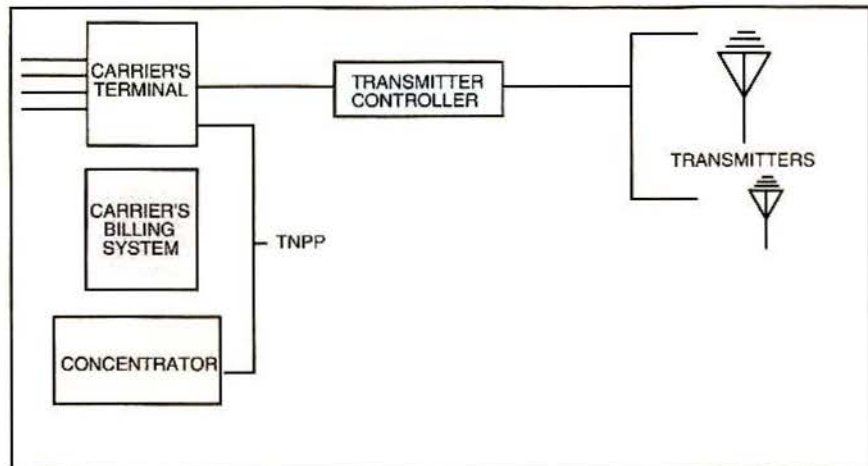


Figure 2. TNPP networking makes the reseller a 'virtual' carrier.

Zheng is president of Linktronic Systems, Los Alamitos, CA.

voice mail and subagents, a paging and voice mail concentrator can pay for itself in as short a time as one year.

Using a paging and voice mail concentrator, further revenue can be created for the reseller from other value-added services such as alphanumeric transcription. With the numbers belonging to the reseller instead of to the carrier, the reseller can move its pagers to another system without changing the pagers' telephone

numbers. The reseller has gained control over its destiny and is no longer locked into a carrier. As the reseller's volume increases, it can negotiate for better prices in the future. Value is added to the client base, because the reseller is no longer captive. If the reseller desires, it can route its pagers to multiple carriers, or, in the future, it can choose to establish its own transmission system and move its existing accounts to it. Upon resale of the busi-

ness, the value of the customer base would be dramatically increased.

The carrier also benefits from the TNPP networking arrangement. The costs for the carrier are reduced, because the carrier no longer needs to pay for phone numbers and circuits. Additionally, all programming and customer service are supported directly by the reseller. The only responsibility of the carrier is to provide paging transmission for the reseller. The carrier can also use the paging concentrator to bring in phone lines from remote locations, thereby consolidating telephone company expenses.

To create these networking benefits, Linktronics Systems designed a paging and voice mail concentrator, the Infolink-2000. The system is designed to expand from four to 128 trunks, and from 5,000 to 1 million users, with from 60 to 3,000 hours of voice mail storage.

To select a paging and voice mail concentrator, the following areas should be considered:

- ☐ Functionality
- ☐ Expandability
- ☐ Ease of use
- ☐ Technology and upgradability
- ☐ Cost

Functionality in a paging concentrator includes the ability to support different types of phone lines such as DID, Loop Start, T1 and ISDN, advanced features in voice mail, the support for agents access, alphanumeric transcription and multiple TNPP and TAP ports.

A paging concentrator based on computer technology provides an alternative for companies lacking a dedicated system engineer to take care of the system. With the Windows-based user interface, any employee can work with the system.

Expandability allows the system to grow as you grow. A system that expands to over 96 trunks, with in-cabinet upgrades and voice mail storage, can expand to several thousand hours as an advantage.

Technology and upgradability are very important. A paging concentrator with a Windows-based graphics user interface (GUI) and DSP-based digital signal processing will be beneficial. Ease of upgrades to accommodate emerging electronics and computer technology, and software, is an important factor.

Regarding cost, make sure that you get the most features, functions, expandability and technology from a concentrator for the most affordable price. Consider the cost of a future upgrade. Future expansion expenses may negate any savings from a low-cost startup.

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(continued from page 8)

should be corrected so that the antenna presents a proper 50Ω impedance to the transmission line, which, in turn, will present the 50Ω impedance to the transmitter. Because the transmitter is designed to work into a 50Ω load impedance for optimum performance, every effort should be made to make the impedance at the transmitter equal to 50Ω .

If this is not possible, and the transmitter must be operated into a line with moderate VSWR, the following technique should be used. An in-line wattmeter is connected between the transmitter and the transmission line using a length of coax, such that the length of coax plus the in-line section of the wattmeter are exactly $1/2\lambda$ at the operating frequency. Be sure to take into account the velocity factor of the connecting line. (See Figure 5 on page 8.) With the wattmeter connected through a $1/2\lambda$ section of line (plus wattmeter section), the transmitter is loaded and tuned for proper power output. Then, the wattmeter and connecting line are removed, and the transmission line is reconnected. The transmitter output should see the same impedance it saw during the tuning procedure.

Line loss masks true VSWR

When you check the forward and reflected power at the transmitter output, you are not getting the actual reflected and forward readings that exist at the antenna, unless the line loss between the transmitter and antenna is quite small. For example, suppose that a catastrophic failure occurs at the antenna transmission line connection—either open or short circuit. Theoretically, this represents a VSWR of infinity. However, if the line has a loss of 3dB, the actual VSWR seen at the transmitter will be about 3:1. Obviously, high VSWR levels can go virtually undetected by measurements made at the transmitter when line loss is high. The line loss acts like a pad to smooth impedance bumps. Such padding is desirable on low-level signal generators but not on high-power transmitters.

Lightning protection?

An old practice among many technicians is to use a shorted transmission line stub to provide a degree of lightning protection. A shorted $1/4\lambda$ stub is placed on the transmission line using a "tee" connector. The length of the stub is $1/4\lambda$ at the operating frequency with the velocity factor of the line included. The stub has negligible effect on the system at the operating frequency but puts a dc short

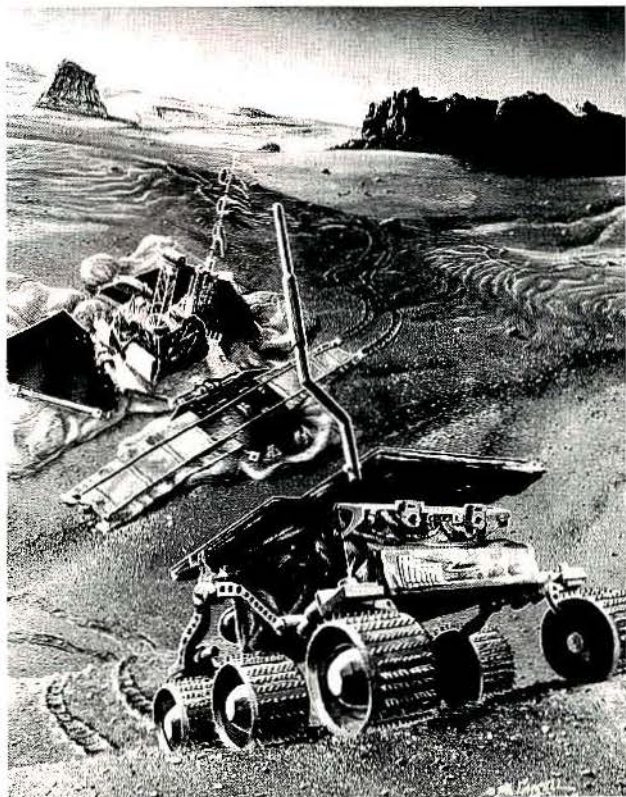
across the line to offer some measure of protection against lightning. I won't argue for or against the merits of such a lightning protection scheme.

Similarly, $1/4\lambda$ stubs can be used as notch filters to notch out interfering signals. Good-quality cables with high velocity factors are generally more effective for such purposes.

I hope this has provided some insight

into working with transmission lines and avoiding some pitfalls along the way. The RF transmission line is more than just a conduit through which RF energy is passed. It is a complex electronic circuit with many features that can be used to great advantage.

Until next time, *stay tuned!*



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Mr. Blandings builds his dream agency

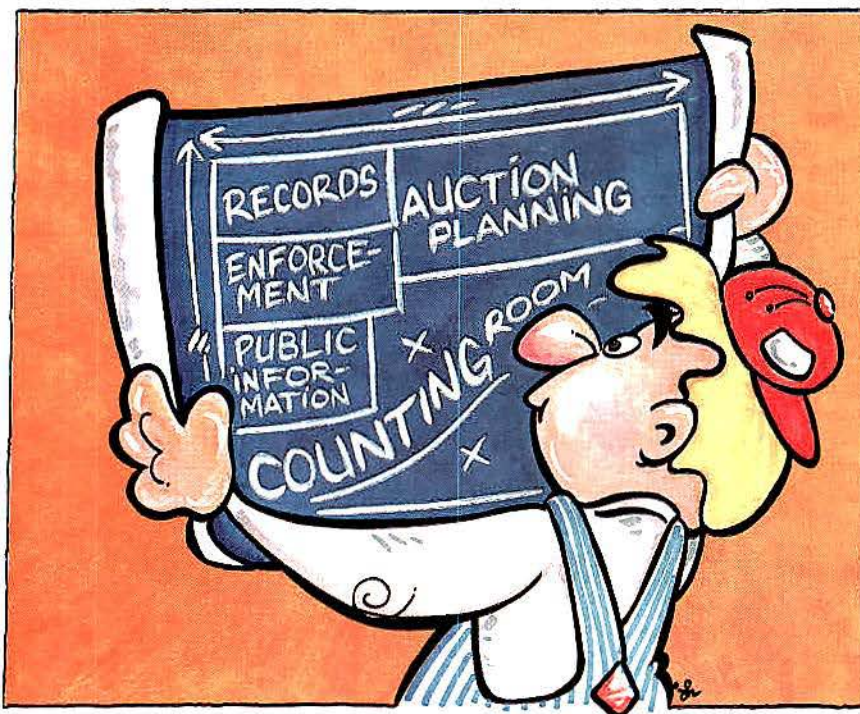
By Robert H. Schwaninger Jr.

Into every generation come the buzz words of the time. They creep into law, technology, business plans, financial forecasts and the newspaper articles that the common man reads in an effort to keep up with the changing times and tides of our industry. They break upon the shores of logic, sometimes eroding the hardened rocks of science, creating tide pools where little creatures borne of farce scurry and hide.

Buzz words are the jumper cables of logic. They pass over the slower process of analytical reasoning, unconcerned with the balancing of what is practical, to reach what might be possible. The circuit that regulates energy using the slower process of research, development, cost, market analysis, and profit potential is bypassed. Buzz words are the "Wouldn't it be neat if . . ." of our society, promising panaceas for everything and deterred by nothing, least of all the mundane nature of time.

In the world of telecommunications, we use buzz words like most people use paper towels—with utility and fully disposable. Remember when "wireless" was an arcane word used to describe the basic dream of Marconi. In the words of Cole Porter, everything that's old is new again, and now "wireless" has reentered our vocabulary as the radio wave of the future. Signal-to-

Schwaninger, MRT's regulatory consultant, is a partner in the law firm of Brown and Schwaninger, Washington, DC. He is a member of the Radio Club of America.



noise ratios have given way to price-earnings ratios. Broadband doesn't refer to the all-girl ensemble in the show *Cabaret*, and the phrase, "private mobile radio services," has been used to avoid the less politically sensitive abbreviation for private mobile services.

Even the word "competition" has taken on new meaning. Competition used to refer to an activity taken up between opponents vying for supremacy. Now, competi-

tion is a taking up of experimental technologies, without regard to supremacy, but rather toward viability and earnings sufficient to justify company debt. Meanwhile, the FCC promotes this activity, urging a greater number of consumer choices without considering whether they are overbuilding the spectrum with new, ultimately unsuccessful, ventures.

It is competition without demand. Or, if you will, a race with no fans, no

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cheerleaders and no winners. The only obvious beneficiary is the race promoter, the FCC, which has taken to charging a hefty entry fee to the participants.

In a July 18, 1997, Public Notice, the FCC invited the public to comment on its "Strategic Plan" to be submitted to Congress pursuant to the Government Performance and Results Act of 1993. The small circle of readers of this strange document are treated to a litany of buzz words and pat phrases. One can also garner some insight into the directions and machinations of this increasingly odd agency. Like Cary Grant as the hapless title character in *Mr. Blandings Builds His Dream House*, the agency has drafted out a floor plan to solve all its imagined woes. (For younger readers, reference the later movie *The Money Pit* with Tom Hanks.)

The FCC listed its objectives as, in order of priority, "authorization of service, policy and rulemaking, enforcement and public information services." At the outset, one might wonder whether the agency was thoughtful when it listed enforcement as its number-three priority. The records would place it in a distant fourth position. Then again, given the secrecy that often surrounds its true motivations for taking various positions, perhaps information is number four.

Within the document, the FCC states that it will improve its licensing as follows: "We will design and implement re-engineered licensing and authorization processes to reduce the time it takes for existing licensees to obtain approval for the introduction of new or improved telecommunications services."

You've got to be proud of the agency that wrote this sentence. No corporate

communications department could have done better. We've got the time-honored opening phrase "design and implement," which always connotes a promise of rapid progress. Throughout the remainder of the document, the FCC promises to streamline, implement, establish, utilize, restructure, encourage, reduce, eliminate, identify and increase. Each one is a powerful verb that leaves the reader in awe of the vast commitment of the agency.

In the preceding example, the FCC will also "re-engineer" its processes. If you are unfamiliar with the concept of re-engineering, it means looking at what you have as though none of it existed and visualizing what you would want to have in a better-engineered operation. Then, making decisions based on the vision, you toss out the old and bring in the new, employing a wrecking ball management style. This technique can be effective, assuming the vision is correct. Anyone who has totally redesigned their kitchen is familiar with this method. The problem is that the primary architect is as likely to be Mr. Blandings as anyone else.

Finally, with a tip of the hat to Madison Avenue, the FCC used the phrase "new or improved." Okay, they didn't say NEW AND IMPROVED, but they were close enough to make the whole thing sound like an ad campaign, which, in fact, it is. The whole exercise is an advertising campaign for Congress, to ensure that the agency gets a healthy market share in the budget process.

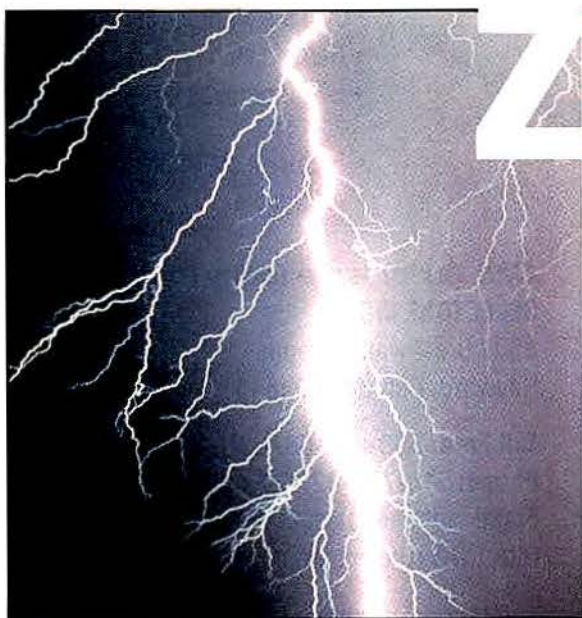
To save you the time of reading the FCC's document, complete with "strategic objectives and performance indicators," let me sum it up with a simple list. For clarity, I'll avoid language used by the agency. In

sum, the agency intends to: (1) push hard for its electronic filing agenda; (2) hold auctions whenever possible; (3) deregulate; (4) promote competition, see above; (5) respond more quickly to informal complaints; (6) tabulate the nature of telephone calls received; (7) use monitoring stations for resolution of interference problems; and (8) expand the use of the call center and the Internet. The FCC's progress in each area will be tabulated and made into quarterly or annual reports, suitable for framing.

A careful reading of the document shows that the methods that the agency intends to use are almost exclusively electronic. Filing applications, making comments, information gathering and dissemination, rulemaking, complaints and every other noted function of the agency will be enhanced, improved and re-engineered to remove the pesky human element. Taking a page right out of the regional Bell operating company (RBOC) service manual, your hope of sitting down with an FCC customer representative just got re-engineered into the past.

It seems that Mr. Blandings' Dream House for the FCC will have quite an echo. It will be vacant, except for the whirring and popping of machines that electronically accept your applications, payments, and pre-sorted complaints. The air-conditioning unit will be the finest, to further chill the cold digitized decisions and tabulations, sent with greater efficiency to "Dear [fill in the blank]."

Who knew that among public interest, convenience and necessity, convenience would win out? The FCC's "Strategic Plan" is to construct an automat of law and policy. But did you ever taste the food in one of those joints? It's hard to swallow.



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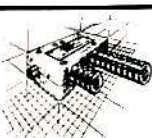
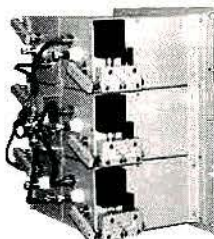
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Circle (30) on Fast Fact Card

Bell Atlantic NYNEX Mobile arms Charlotte, NC, police with more information to fight crime

Bell Atlantic NYNEX Mobile, Bedminster, NJ, and the Charlotte-Mecklenburg, NC, Police Department are equipping the local police fleet with cellular digital packet data (CDPD).

Laptop computers using Bell Atlantic NYNEX Mobile AirBridge CDPD service will be installed in more than 460 Charlotte-Mecklenburg police vehicles, including patrol cars, mobile command post, SWAT van, crime scene vans, patrol boats and the canine unit vehicles. The service will provide officers in the field with nearly instantaneous wireless access to information before they approach a vehicle, house or suspect, allowing them to make critical decisions that will enhance their own safety as well as that of the community.

Charlotte-Mecklenburg will be the second-largest public safety application of CDPD technology in the nation. The system will give officers access to local, state and national law enforcement databases to retrieve complete motor vehicle records, criminal warrants, police reports, GIS and other information in seconds.

The software, which is being provided by Cerulean Technology, Marlborough, MA, allows officers to connect to national, state and federal databases, police information systems, the National Crime Information Computer (NCIC) and the North Carolina Division of Motor Vehicles.

The mobile computer systems will also increase the security of police department communications. Messages are encrypted by both the software and the CDPD network to prevent unauthorized reception.

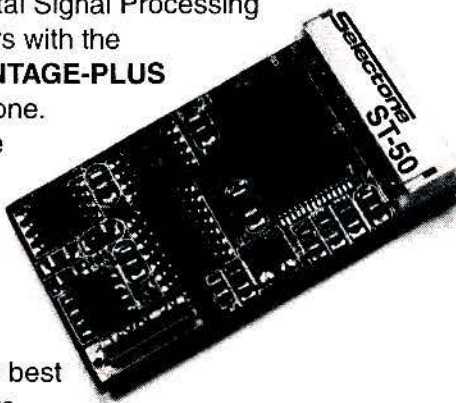
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Circle (31) on Fast Fact Card

Metrocall, ProNet announce merger

Metrocall, Alexandria, VA, and ProNet, Dallas, have signed a merger agreement. ProNet would merge into Metrocall, creating a paging company with more than 4 million subscribers. Metrocall is issuing 0.9 shares of Metrocall common stock for each share of ProNet common stock. ProNet is appointing three directors to Metrocall's board, including ProNet's current chairman, Jackie Kimzey.

Glenayre receives volume purchase agreement from Celpage

Glenayre Technologies, Charlotte, NC, has signed a two-year volume purchase agreement valued at more than \$7 million with Celpage, a private paging provider for Puerto Rico.

Through the agreement, Celpage will purchase Glenayre's advanced high-speed paging infrastructure, including the GL-3930 Operator Assisted Paging system, GL3000 wireless messaging switches, GL-C2000 control system and GL-T8501 and 8601 transmitters. Glenayre's system will provide Celpage with the capabilities for alphanumeric paging, as well as a simple migration path to two-way paging in the future.

AAT Communications opens multi-user Las Vegas facility

AAT Communications has completed its first multi-user monopole to improve wireless coverage in the Las Vegas market. The monopole accommodates users of PCS, cellular, ESMR and paging (two-way and receiving). This is the first of many monopoles AAT will be constructing in the Las Vegas business trading area (BTA) during the next few months.

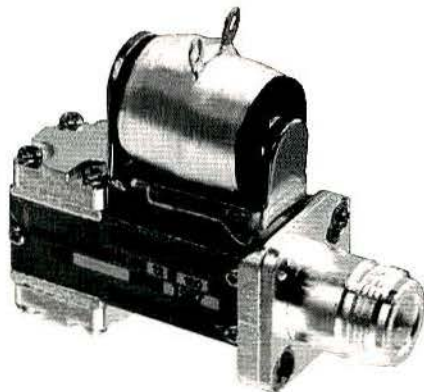


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poof.

Preventing downtime due to lightning is now much easier with the Cutler-Hammer line of Clipper Telecommunication (Tc) Panelboards.

Clipper Tc Panelboards integrate an automatic or manual transfer switch and surge protection filter into a panelboard. Its unique design significantly reduces wall space and installation costs, while providing superior surge protection that has been independently tested. Custom configurations are available to meet your load switching and remote generator monitoring requirements.

Another industry surge protection breakthrough from Cutler-Hammer.



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EAT-N

Circle (47) on Fast Fact Card

Miami to host Latin America telecommunications trade show

Miami will host TelecomLatina, a new trade show for the international telecommunications industry. The conference and exhibition will take place Oct. 14-16, 1998, at the Miami Beach Convention Center.

More than 150 international manufacturers and distributors will display the latest technology in wireless communications including two-way radio and trunking,

cellular, PCS, TV and satellite broadcasting and other technologies included in the "information superhighway." Three days of sessions and tutorials are being offered, and the show organizer, a division of the company that owns *MRT*, expects more than 2,000 attendees.

Prior to the show, a one-day seminar, "Telecommunications in Latin America," will be offered to help U.S. exporters.

Motorola forms systems management business

Motorola's Land Mobile Products Sector, Schaumburg, IL, has launched a new business that will provide comprehensive systems management support for both the wireless and wired systems that comprise sophisticated two-way communication networks.

The business brings together the communications systems experience of the sector's radio systems division and the service of its United States and Canada service division, to support its customers' communications networks, as well as information technology. The multitechnology systems management approach will support customer communications systems including all communications equipment used in conjunction with two-way radio systems through a broad range of consulting, planning and technical services.

El Paso Energy, a Houston-based natural gas pipeline operator, has contracted with Motorola to provide systems management support for its wireless communications system that extends across the continental United States.

Motorola specifically will support all of El Paso Energy's mobile and portable radios, manage its spare radio inventory, dispatch technical support services as necessary nationwide, and manage the reporting process El Paso and Motorola will use to gauge overall system performance.

Geotek provides Hilton with guest check-in, airport transport service

Geotek Communications, Montvale, NJ, is providing Hilton hotels with a mobile check-in service that allows travelers to check into their hotel upon boarding the Newark Airport Hilton shuttle van. Geotek's systems integration subsidiary, GMSI, developed Hilton's new Mobile Zip-In by implementing Geotek's wireless network service, mobile workstation and GMSI's automatic vehicle locator (AVL).

Geotek's network and services allow the Hilton shuttle to operate as a remote check-in desk. The service includes an in-vehicle card swipe for advanced check-in and constant communication with the hotel using an integrated mobile workstation. The hotel can locate and monitor all vehicles through integrated AVL software to ensure an efficient dispatching and pickup service. The service also includes emergency response capability.

Geotek's hardware and software is currently installed in all seven of the Newark shuttle vans. Geotek and Hilton are exploring plans to expand the program.

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Reliability

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Readers' choice

Of all the new products and services in the March 1997 issue, the one reprinted here generated the most reader requests for additional information. If you missed it the first time, here is your opportunity to acquire more information on it. Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

Hand-held scanners cover multiple bands, including 800MHz channels



Relm Communications has revived its consumer products sector with the introduction of the HS 100 and HS 200 multiband programmable scanners. The HS 100 scanner has 100 channels and 10 banks covering 12 bands, including aircraft and government. The HS 200 covers 13 bands, including 800MHz with 200 channels and 10 banks. Features of the HS 200 include PL/CTCSS and DPL/DCS. Both scanners have fast scan, bank scan, weather scan, priority scan with hierarchy, direct channel access, search, search hold, channel lockout, birdie lockout and LCD. Standard accessories include ac adapter, ear piece, carrying strap and belt clip. The unit is powered by four side-loaded AA batteries.

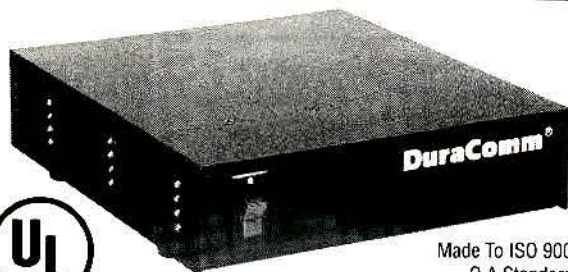
Circle (500) on Fast Fact Card

Product line features tapered steel poles

UNR Rohn's tapered steel poles at heights of more than 200 feet have been added to the product line. The poles are produced by Sherman Utility Structures in its North American Pole Company manufacturing plant in Dallas. The tapered poles are multisided steel structures. They can be hot-dip galvanized locally or at Rohn's expanded galvanizing plant in Peoria, IL.

Circle (301) on Fast Fact Card

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Cutler-Hammer

EATON

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New products

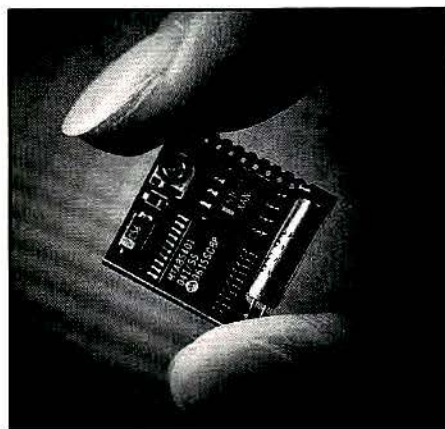
Customized shelters house communications equipment

Utility Structures' Versa-Shelter customized, pre-fabricated shelters meet all standard and non-standard equipment shelter requirements. The customer's specifications determine construction methods, interior and exterior materials and appearance. Various construction options are available. Construction options include a variety of insulation values, roofing styles, sidewalls and floor

construction and load ratings. Electrical and environmental equipment and controls can also be installed to provide an internal environment suitable for all forms of instrumentation, communications and power equipment. These structures can be shipped with optional electrical and mechanical systems pre-installed and tested.

Circle (302) on Fast Fact Card

Digital ANI: Compatible with Motorola® MDC-1200®



Micro-Minature ID-12

Manufactured by Control Signal®, the ID-12 ANI encoder is a cost-effective way to upgrade all the radios in your fleet with ANI that is compatible with Motorola MDC-1200. Works in all radios, and its tiny size (.59" x .65" x .12") allows it to fit in virtually all hand-holds. Has leading and trailing IDs, emergency, and time-out timer. Fleet price (100 qty) \$89 ea.

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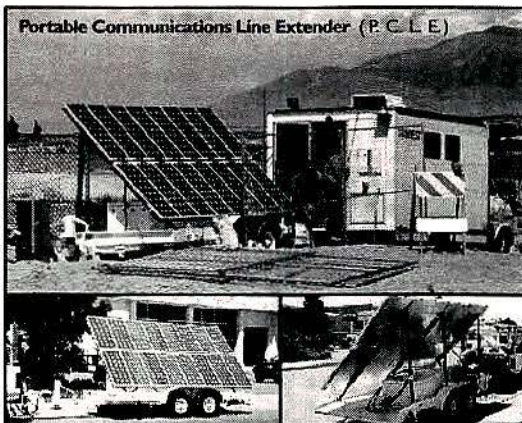
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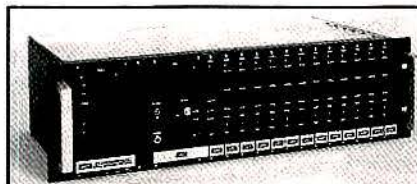
Pagers line targets young adults



The Digitz numeric pager is the newest addition to Motorola's Lifestyle series of paging products. This pager is designed to appeal to young adults. The pager combines consumer-friendly functions and a full range of features with modern, colorful styling. Digitz is easy to read in any lighting condition with its top-mount, backlit LCD. The pager accommodates as many as 16 numeric messages, which can be stored and locked into memory for extra protection. Digitz users can easily select how they should be alerted, choosing between a musical alert or silent vibration. Digitz also offers a durable, removable belt clip for easy-to-wear flexibility. The pager can be customized with a selection of color belt clips or other pager accessories, such as bungee cords and lanyards.

Circle (303) on Fast Fact Card

Voter measures signal-to-noise ratio



The SNV-12 from JPS Communications is a modular receiver voting system that uses individual digital signal processing (DSP) channels to measure the signal-to-noise ratio (SNR) of received signals for determination of the best-received signal. The unit accommodates from two to 12 receiver site voter modules in one chassis and interfaces easily with standard dispatch consoles. This is a function in two types of applications. The first is a two-way radio application in which mobiles and portables can hear a repeater, but the repeater cannot always hear the mobiles and portables. By positioning remote receivers in the communications dead spots, audio from each receiver can be linked to the voter via microwave, land line, twisted pair or fiber optics. With the unit providing the "voted" (best SNR) output to the repeater for rebroadcast, all mobiles and portables can hear each other because the repeater can hear them all.

Circle (304) on Fast Fact Card

Class A transmitters measure signal propagation

The Berkeley Varitronics Systems Gator transmitters measure signal propagation, position antennas, set power levels or validate coverage. The transmitters have FCC type acceptance. All models are available with full remote control via modem or DTMF control. They have a built-in forward and reverse power meter, as well as VSWR monitoring with digitally controlled and regulated output. The transmitters guarantee the power to the antenna to be constant, regardless of load. Transmitters are available with either 25W Class A, 45W Class A models (10W or 20W Class A for PCS models). The transmitter weighs 25 pounds, and available frequencies include PCS, cellular, LMR, ISM, IDS, SMR, AMPS, ETACS, PACS and paging.

Circle (305) on Fast Fact Card

RF propagation PC software adds features

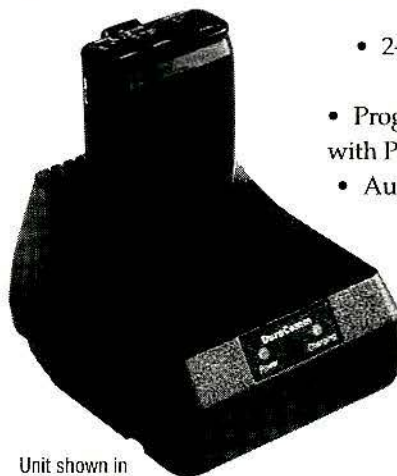
Communications Data Services' RFCAD 2.0 is a version upgrade of the program for PC propagation analysis. The version 2.0 software enables flexible and comprehensive RF design and analysis capabilities for the broadcast, PCS, cellular, public safety, land mobile, SMR and paging industries. RFCAD 2.0 allows users to analyze predicted RF coverage for planned and existing facilities or systems and to display the results over detailed topographic maps. RFCAD 2.0 provides users with the ability to calculate predicted FCC contours as well as to conduct detailed terrain analysis studies. RFCAD 2.0 is a 32-bit application designed to work within the Microsoft Windows 95 or Windows NT 4.0 environments.

Circle (306) on Fast Fact Card

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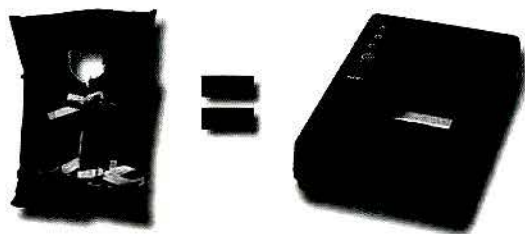
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Circle (55) on Fast Fact Card

New products

Plenum cable supports in-building communications



Trilogy Communications' Aircell Plenum is a plenum-rated 50Ω coaxial cable designed to meet the safety and performance requirements of in-building wireless communications. Aircell Plenum is suited for applications requiring distribution of RF in confined areas where fire-code requirements dictate a plenum-rated (UL-910) cable, such as multistory commercial and residential

buildings, hospitals, manufacturing facilities and other RF-restricted locations. The cable features a corrugated outer conductor with a flame-retardant PVC jacket to provide handling flexibility. Performance characteristics include a maximum attenuation of 2.45dB per 100 feet at 1GHz and 3.5dB per 100 feet at 2GHz for PCS applications. The design includes no Teflon.

Circle (307) on Fast Fact Card

Base station offers technology-independent approach

Innovation's UBS 2001 is a technology-independent, fully integrated base station that simplifies and expedites wireless network deployment. The open architectural design of the UBS 2001 can be scaled for both macro and microcell applications and can be integrated with radio equipment from most providers. The modular design divides base station equipment into independent units that house services, power and RF technologies.

Circle (308) on Fast Fact Card

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The STI-9100 Mobile Signal Measurement and Analysis System

From measurement to report, the STI-9100 is the most cost-effective and easy-to-use signal measurement and analysis platform on the market.

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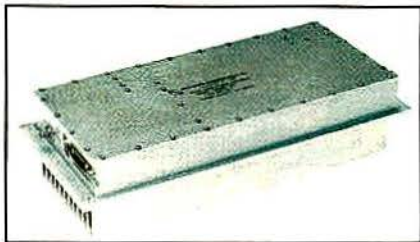
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Email: marketing@surveylech.com

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Circle (56) on Fast Fact Card

Amplifier uses Class 'C' biasing



Microwave Power Devices Technologies' 175W, high-power amplifier (model HPA940-175) uses Class "C" biasing for the output stages to achieve required efficiency. The amplifier has a manual power output adjustment that reduces the output level below 20W and a remote control with eight user-selectable levels. The unit also includes a TTL control for bias on-and-off and remote sensors for both VSWR and temperature faults. Although the amplifier was specifically designed for 940MHz paging applications, it is also suited for use in CDPD systems. Operation at other frequency bands is possible with modifications. The amplifier has an operating temperature range of 0°C to 50°C, measures 3.5"×5.75"×13" and operates at 26V dc.

Circle (309) on Fast Fact Card

Encoder option tests Flex protocol



IFR Systems has added paging options to its COM-120B service monitor. The AC510 encoder option, when combined with the microprocessor-controlled COM-120B, is a plug-in-and-play test suite for analog and advanced digital paging systems. The encoder has a frequency range from 250kHz to 1GHz with encode and decode two-tone sequential and DCS and DTMF capabilities. The encoder option allows testing of Motorola's Flex two- and four-level, tone-only, numeric and alphanumeric display for GSC, NEC D3 and POCSAG 512-, 1200- and 2400-baud and Golay sequential code digital paging formats.

Circle (310) on Fast Fact Card

Monitor, site controller reports 240 alarm conditions

Barnett Engineering's FLX remote site monitor and site controller, the ProTalk FLX, allows you to monitor and report as many as 240 varied alarm conditions, including digital, analog, loss of events, totalizers and RF power. Alarms can be reported and acknowledged over telephone lines, cellular and satellite telephones, mobile radio systems, pagers and RS-232 ports. Site conditions can be con-

trolled remotely by the initiating of activation codes by the receiving operator. PC programming is supplied with the unit. Digital inputs can be programmed as alarms, interval timers, totalizers or watchdog timers. The FLX is suited for industrial applications including radio and paging equipment sites, boilers, engine monitoring or electric substations.

Circle (311) on Fast Fact Card

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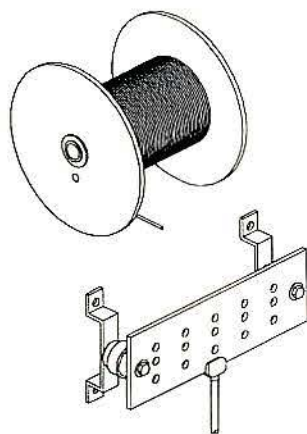
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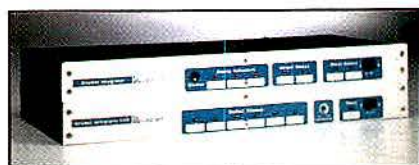
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Circle (58) on Fast Fact Card

New products

Module integrates UPS control, monitoring, security



Liebert's Sitenet Integrator LCM (load control module) integrates remote UPS control, environmental monitoring, site

security and receptacle load control into Liebert's Sitenet Integrator. The LCM provides remote power management of connected equipment loads and allows the network manager to control remote equipment through on and off commands or by programming the Integrator to automatically respond to alarm conditions. Power can be cycled to reboot equipment, or turn off equipment based on input conditions to the Integrator. The Integrator has user-configuration inputs for site-specific monitoring and control, and traps and alarms can be generated on 36 power environmental or security events. It provides management capability to the software that oversees your network.

Circle (312) on Fast Fact Card

Mount presents alternative to building new towers

The Powermount from FWT, which can be used to install a sectored antenna array on an existing tower without adding to the compression load, presents an alternative to the construction of new towers. As a modification to an existing tower, the installation of a Powermount can limit zoning obstacles and help reduce the visual pollution caused by proliferation of towers.

Circle (313) on Fast Fact Card

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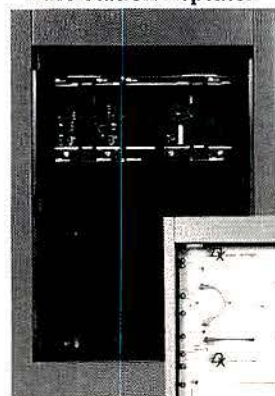
Call DX Radio Systems or your local DX area Representative for information regarding product specifications, pricing and placing your orders.



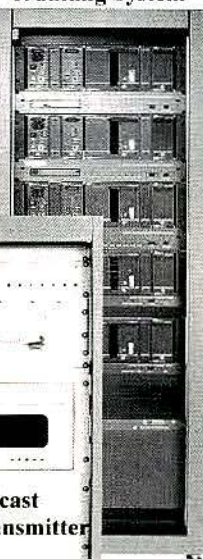
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Trunking System



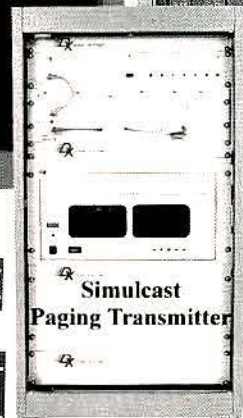
Compact Repeater



RTF Repeater/Base



Simulcast
Paging Transmitter



Circle (59) on Fast Fact Card

Tower amplifier improves receiver performance

Huber+Suhner's tower-mounted amplifier (TMA) for North American PCS networks improves the base station's receiver performance, enabling good reception of the customer's device. It is common for the application of TMAs to double the area of reliable coverage. Doubling the coverage area can reduce the initial investment in base stations, easing network roll-out plans and reducing the environmental impact. The MCTA1900 TMA is an open-protocol (TDMA or CDMA), small, high-gain (12dB) TMA, designed to be mounted in an outdoor environment near the antenna. With redundant amplifiers and frequency duplexers, the MCTA installs in-line on the coaxial line to the antenna. Transmit, receive, power, alarm and control are integrated into the same coaxial line.

Circle (314) on Fast Fact Card

Rugged mounts offer durability and flexibility

The rugged duty Uni-lok mount from SMC Cellular Phone Mounts offers durability for medium-to-heavyweight installations. The 3/4" diameter shaft allows one-point adjustment of 360° rotation and 170° tilt at top or bottom. The 9" rugged-duty Uni-Lok can be ordered with dual ball joints for two-point adjustment. The 5" mount is supported by a 3" round base. For added stability, the 7" and 9" mounts are supported by a 4" square base. Mount swivel is milled from aircraft-grade aluminum. All mounts include a universal 511 top plate and are assembled with thumbscrew (T-knob) fasteners. Optional set screw fasteners and hex key are included.

Circle (315) on Fast Fact Card

TRANSMITTER LOCATION



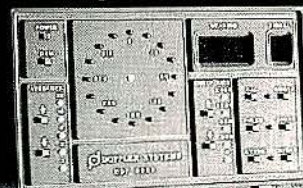
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Circle (32) on Fast Fact Card

Ritron RF Transceivers—The Wireless Connection

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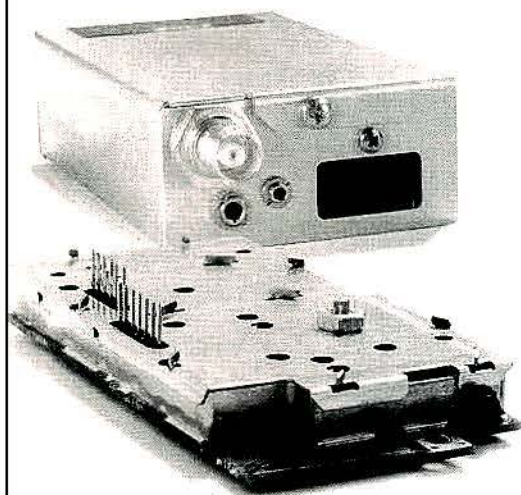
Synthesized, programmable RF transceivers for OEM and custom wireless data and voice applications. Utilizing the latest in SMD design and micro-processor technology, the DTX RF transceiver offers reliability and low-cost without sacrificing features and performance.

The DTX Series of RF transceivers includes a complete stand-alone module consisting of an RF transceiver and microcontroller-baseband module in an enclosure.

And for lower cost and highly integrated applications, where the user is prepared to supply RF synthesizer data and conditioned signals, the DTX RF transceiver board is available separately.

DTX Transceiver Standard Features:

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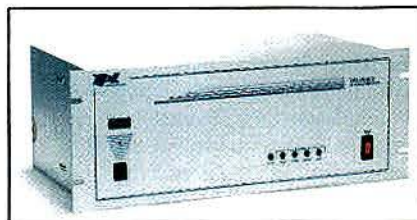
New products

Power amplifier accepts levels as high as 150W

TPL Communications' LMS series power amplifier has all the features of the HMS series high power amplifier in a unit with medium output levels.

This smaller package will accept any power level as high as 150W from 35MHz to 960MHz. It is built for rugged use and comes in a space-efficient package. It is totally self-contained with regulated switching power supply, two cooling fans, SWR and temperature protection circuitry. The units are self-monitoring. Digital meters have been added to provide readouts of test conditions.

Circle (316) on Fast Fact Card



Notebook integrates laptop, wireless communications

Melard Technologies' Scout all-terrain subnotebook provides laptop functionality combined with integrated wireless communications, long battery life and a lightweight, rugged construction. Scout withstands rigorous daily use in severe environments. Its field impact control system includes a magnesium enclosure, energy-absorbing bumpers and a shock-mounted hard drive. The TFT active matrix color and monochrome displays are easy to read.

Circle (317) on Fast Fact Card

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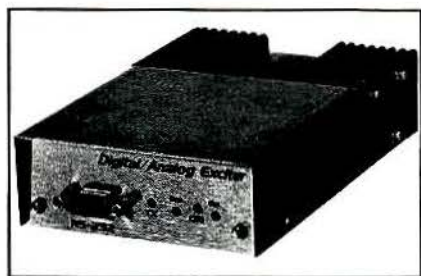
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Circle (35) on Fast Fact Card

Transmitter and exciter offer digital and analog modulation



The DPT series from RF Neulink is a continuous-duty VHF paging transmitter and exciter with both digital and analog modulation capabilities. A digitally compensated reference clock and precise modulation characteristics make the DPT series suitable for the most common paging formats including POCSAG, Golay, RZ, NRZ and two-tone at signaling rates as high as 2,400bps. The DPT series is fully synthesized and can be easily programmed in 10kHz or 12.5kHz increments via a built-in RS-232 port. Several modes are available covering the 136MHz-174MHz, 218MHz-230MHz and 260MHz-280MHz frequency ranges. Output power is adjustable with a normal maximum output of 5W in the 136MHz-174MHz frequency range and 2W in the 218MHz-230MHz and 260MHz-280MHz ranges.

Circle (318) on Fast Fact Card

Paging encoder supports Flex, POCSAG and Golay formats

Linktronics Systems' PageLink-2000 version 3.0 is a computer-based digital paging encoder that supports all speeds of Flex, POCSAG and Golay formats for both numeric and alphanumeric pagers. The encoder runs in DOS and Windows 3.1 or Windows 95 and NT. The encoder features capcode increment and decrement, simple configuration change, and pre-programmed canned messages of as many as 240 characters in numeric and alphanumeric format. The user can also define his own canned messages in an external file. The encoder features page repetition with automatic message increment and supports two-byte international character sets. Other features include automatic transmittal of the NEC test mode, continuous paging and preamble mode, four-level analog output or two-bit digital output. Additional options include a Samsung over-the-air programmer, callable programming interface and transmitter control.

Circle (319) on Fast Fact Card

Flasher and beacon alarm relays enable remote monitoring

The FB from SSAC is a series of remote monitoring alarm relays. The flasher and beacon alarm relays are used to monitor the operation of one two-lamp beacon and one beacon flasher (or auxiliary module). The flasher and lamps are monitored by sensing the flow of current in the circuit. If the lamps or the flasher fail to operate properly, a solid-state output and an isolated single-pole double-throw re-

lay energize. It is factory-calibrated and tested. When connected to a site monitoring system, this unit provides the remote beacon monitoring protection required by the FAA and FCC. On a multiple beacon structure, one unit is required for each two-lamp beacon. The FB series may be ordered with an operating voltage of 120Vac or 230Vac, 50Hz and 60Hz.

Circle (320) on Fast Fact Card



Receive only	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	Comp. (dB)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET	\$44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET	\$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET	\$44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET	\$56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET	\$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar	\$49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar	\$74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	\$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET	\$119.95
Inline (rf switched)						
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET	\$74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	\$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	\$74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	\$86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET	\$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar	\$79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar	\$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET	\$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8970A/HP346A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N improvement 6-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include \$2 shipping in U.S. and Canada. C.O.D. orders add \$2. Air mail to foreign countries add 10%. Order your ARR RX only or inline preamplifier today and start hearing like never before!

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New products

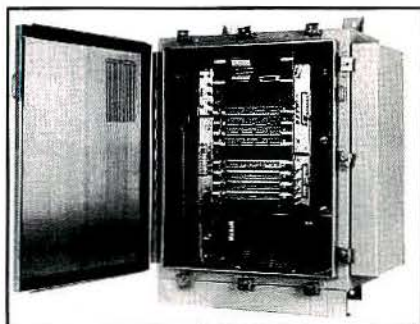
Battery support system operates on mains power anywhere

The CASP/1500 from Christie Electric is a microprocessor-based precision instrument for maintaining any rechargeable battery at peak performance. Rated at 250W of charge power the system is suited for commercial applications. It is lightweight and can operate on mains power almost anywhere in the world, accepting inputs from 90Vac to 365Vac at

frequencies from 4Hz to 440Hz. The system is pre-programmed and designed for simple unattended operation. Its six channels will sequentially process as many as six batteries of any type. Standard functions performed by the system include battery recognition, charging, reconditioning and analysis.

Circle (321) on Fast Fact Card

CDMA repeater receives type acceptance from FCC



Allen Telecom has received type acceptance from the FCC for the EAC-800 CDMA service in problem areas such as tunnels, convention centers and parking garages and improves coverage in larger buildings, including hospitals and office towers. The CDMA repeater is available in standard or expanded A-band and B-band units. Its dual-mode capabilities enable it to serve both CDMA and AMPS subscribers. The repeater offers a channel-selective option that repeats only a single CDMA channel and expands to repeat multiple CDMA channels on a channel-selective basis. The compact, lightweight unit also gives subscribers flexibility in choosing a location for the repeater.

Circle (322) on Fast Fact Card

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- 104 DCS Codes
- 50 CTCSS Codes
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- CWID Identifier (8 digits)
- Courtesy Beep per User
- 120/240 VAC
- Internal Speaker
- Remote Option Enable/Disable
- Busy Channel Lockout
- Local Control
- Programmable TOT
- Programmable Hang Time

RELM Communications UHF Repeaters and Base Stations come standard with a built-in multi-user tone panel, which allows access to all 154 CTCSS & DCS tones for 16 different users! The DRU 25 Watt Repeater has one channel while the DBU Base Station has 16 channels. Both units are available in these four ranges 400-420, 450-470, 470-490 or 490-520 MHz.

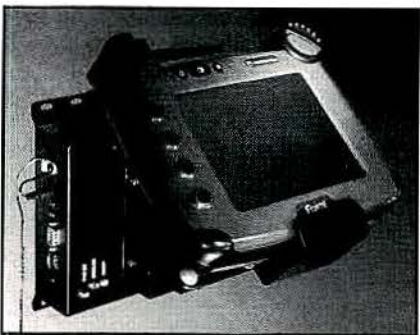
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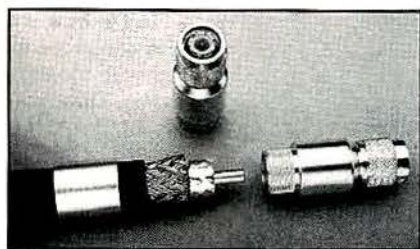
Wall mount doubles as workstation



Scientific Dimensions' SDI 8810 wall mount for the Motorola Forté wireless CommPad offers full docking support. This wall mount cradles and powers the device. This special application is suitable for utilities or public safety personnel who "overnight dock" rows of modules in safe room environments. Docking initiates a battery charge, designed to accurately recharge the commpad for another full day of usage. The SDI 8810 also provides a comm-port and keyboard output connector so the dock can double as a workstation.

Circle (323) on Fast Fact Card

Interface links LMR-600 cables



The EZ-600-TM from Times Microwave is a "no-solder," TNC male interface, knurled coupling nut with crimp attachment for LMR-600. The connector body is silver-plated, and the center pin is gold-plated. The no-solder, captive center contact is made from beryllium copper and fits over the cable center conductor with spring-fingers. The ST-600-EZ strip tool is used to prepare the cable end. The DBT-01 deburring tool is used to chamfer (bevel) the end of the center conductor. The connector is pushed on, the crimp ring slid forward, and crimped. It takes less than three minutes. The included adhesive-lined heat shrink boot, which provides weather-proofing and strain relief, is applied to complete the termination.

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The complete line of AEA antennas and antenna analyzers are now available **FACTORY DIRECT** at the lowest possible cost. Each analyzer gives a **graphical display of SWR curves** with variable sweep width and center frequency. The 30-150, 150-525, and 806-960 MHz antenna analyzers are each \$499.95 plus \$7.50 shipping and handling. The SWR-121 HF analyzer covers 1-30 MHz and is priced at \$299.95 plus \$7.50 shipping and handling.

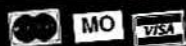
The AEA CableMate™ graphical Time Domain Reflectometer (TDR) is packaged in the same style package as the SWR analyzers. The CableMate shows multiple faults in a cable on the graphical display. Virtually any multi-conductor cable may be tested for shorts, opens or impedance lumps. The CableMate is an excellent device for measuring the length of most any cable for inventory purposes. It will also directly show the 25 MHz return loss. An RJ-45 switch adapter allows easy testing of LAN cables. The CableMate is priced at \$299.95 plus \$7.50 shipping and handling for a limited time only.

All AEA analyzer products come standard with a **serial computer interface**. Store your graphical data with the applications software and interface cable for only \$29.95.

We also manufacture the lowest cost high performance VHF and UHF base station antennas available. Please send or call for our free booklet Facts About Proper VHF Vertical Antenna Design to find out why our IsoPole™ Antennas are SUPERIOR to the competition. Try our IsoPole-150 VHF antenna for \$89.95 plus \$7.50 shipping and handling or the ISO-440 antenna for \$119.95 plus \$7.50 shipping and handling. The HR-3 telescopic VHF Handheld (10 dB gain over a rubber duck) antenna is available for \$29.95 plus \$3.00 shipping and handling.



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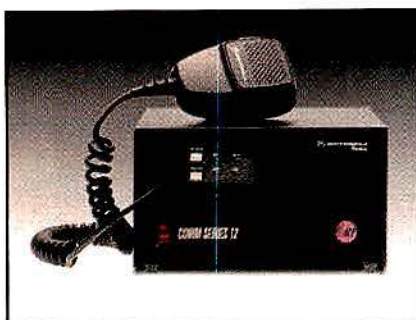


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Circle (40) on Fast Fact Card

New products

Base station covers fit with Motorola radios



ICT's base station covers are for use with Motorola radios. These covers fit the M100, M120, GM300, Maxtrac, SM50, SM120 and the new GTX with the ICT Comm series switching power supplies. The product can be

purchased as a complete base station, or the power supply and cover can be bought separately.

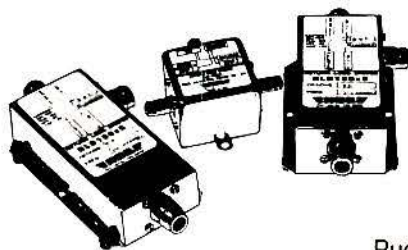
Circle (325) on Fast Fact Card

Product line complies with Project 25 standards

King Communications U.S.A.'s KDR-25 series of VHF, UHF and 800MHz analog and digital base stations and repeaters are capable of analog and digital communications, as well as crossband operation. They fully comply with Project 25 specifications. King's digital site management system allows customers to include RF monitoring, site monitoring, tower light monitoring and hot-standby capability for the base and repeaters. And the KDT-5000 series mobile data system is being adapted to operate in Project 25-compliant systems.

Circle (326) on Fast Fact Card

VSWR BRIDGES & TEST CABLES



FEATURES:

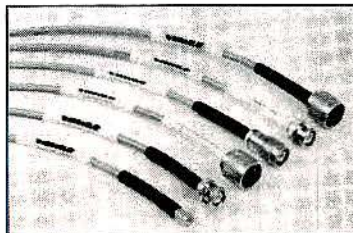
5 watt power
High directivity
RF reflected port
Rugged construction

Using the EAGLE return loss bridge allows frequency domain reflectometry tests to be made easily and inexpensively. There is no need to spend thousands of dollars on a dedicated antenna tester. Simply use the EAGLE bridge with your present spectrum analyzer and tracking generator. This technique is described in our free application note. See offer below.

Price: \$469.00 for a 1.0 GHz bridge.

FEATURES:

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Custom labels
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Excellent return loss



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Circle (41) on Fast Fact Card

DTMF decoder suitable for portable operation



Optoelectronics' Techtoyz is a line of test equipment housed in beeper-style cases. The Techtoyz micro DTMF decoder is suitable for portable, hands-free operation. With its built-in microphone, DTMF tones are automatically decoded from the signal source of tape recorders, receivers, two-way radios or anything else where touch tone can be heard by the micro DTMF decoder. There is also a built-in audio input jack for direct connection to any receiver's speaker output.

The decoder can decode as many as 12.5 characters per second while displaying the characters on its 12-digit LCD.

Circle (327) on Fast Fact Cards

Controller enhances VHF, UHF trunking protocol

The ST-853 digital trunking controller from **SmarTrunk Systems** is suited for larger systems with five to 16 channels, and is compatible with all existing SmarTrunk II logic boards. The larger capacity of the ST-853 accommodates more than 4,000 subscribers per system offering more space to set up roaming subscribers from neighboring systems. As many as 4,500 call records may be stored per controller. The larger memory also allows more features to be programmed on a per-user basis, such as courtesy beep, hang-timers, telephone line access and toll restrictions.

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The Only Way

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Circle (42) on Fast Fact Card

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GP-9NC

DualBand VHF/UHF
High Gain Base Station

Gain:

153-157MHz 8.5dBi

460-470MHz 11.9dBi

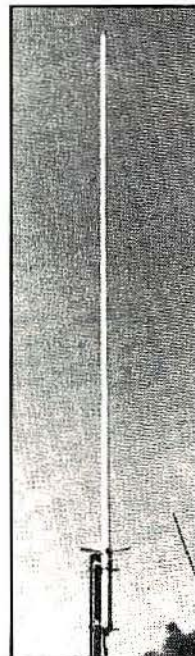
Max Power: 200 watts

Length: 17' 8"

Connector: N-type Female

Construction: Heavy-duty fiberglass,
3 screw together section

UPS SHIPPABLE



FP-19

900MHz High Gain
Omni directional
Base station

Gain: 900-930MHz 16dBi

Max Power: 100 watts

Length: 7' 11"

Connector: N-type Female

Construction: Heavy-duty single
piece fiberglass
UPS SHIPPABLE



FX-555NMO

TriBand VHF/UHF
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Gain:

153-157MHz 2.1dBi

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Max Power: 50 watts

Length: 27"

Connector: NMO

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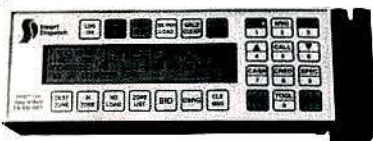
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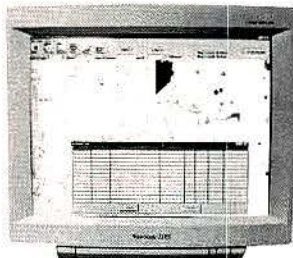
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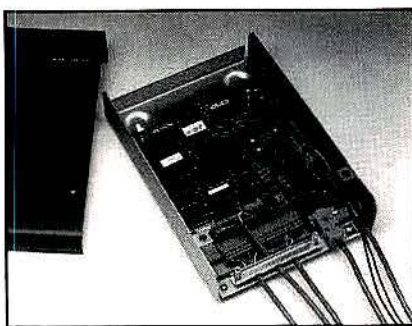
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Circle (44) on Fast Fact Card

New products

Monitoring, control system operates over EDACS

Zetron's Ultrac wireless monitoring and control system is for operation over customers' EDACS networks. Ultrac RTUs include digital and analog inputs and outputs for economical data acquisition, remote control



and alarm monitoring in electric utilities, oil and gas operations, telephone maintenance, plant security and other applications. EDACS networks enable Ultrac systems to operate over wide areas with multiple radio site coverage. Communications can be initiated by alarm conditions at the RTU, by regular polling from the central station and on-demand by the operator. Processing of the data at the control site is done with Ultrac+ software on a PC or via MODBUS interface to the customer's SCADA system. Alarm conditions can trigger telephone autodialers and direct or paging terminal broadcast of voice messages or alphanumeric messages. Ultrac RTU's analog inputs can accurately measure levels, pressures, temperatures and flows at remote sites while digital inputs sense contact closures.

Circle (329) on Fast Fact Card



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Circle (45) on Fast Fact Card



Brown



Fay



Grantham



Mitchell-Byrd

Tyrone Brown, practicing attorney at Wiley, Rein and Fielding, Washington, DC, joins ClearComm, San Juan, Puerto Rico, as senior vice president for regulatory affairs. He remains associated with the law firm as a consultant.

Paul Fay leaves Samsung's U.S. paging division, Deerfield Beach, FL, as national sales manager to join Wireless Technologies Group, Ft. Lauderdale, FL.

Changes at Allen Telecom, Cleveland:

Steve Grantham departs BellSouth Mobility, Atlanta, to join Allen Telecom as account manager for the southwest region.

Jeff Beckerman, systems engineer for PCS products for the Systems Engineering division, moves to applications engineer for the Site Products division.

Atlanta Communications, Atlanta, and its president, **Gwen Mitchell-Byrd**, receive the Motorola Supplier Award for Excellence for innovative and high-quality work management, system installation and service support work for two-way radio customers throughout Georgia.

Ronnie Rand, executive director of Associated Public-Safety Communications—International Officials, South Daytona, FL, departs to pursue other interests.

Robert H. Hensberger leaves Siemens Wireless Terminals, Richardson, TX, as senior vice president to become president and chief executive officer of Metawave Communications, Redmond, WA. Previous chairman and chief executive officer **Thomas S. Huseby** has left the company in a transition that began in February. With Huseby's departure, **Douglas O. Reudink**, previously president and chief technology officer, now is chairman and chief technology officer. He began serving as acting chief executive officer in February, and Huseby continued as chairman during the recruitment of his replacement.

Changes at Andrew Wireless Products Group, Itasca, IL:

Darius Bossinas, graphic services manager, advances to marketing communications manager.

Steven Maher, international marketing manager, moves up to product planning manager.

Stephanie Wiles, automotive accounts specialist, moves up to central regional sales manager.

Changes at Anritsu Wiltron's Microwave Measurements division, Morgan Hill, CA:

Frank A. Tiernan, director of research and development, moves up to vice president of the division.

Eric Liu, manager of the Components Engineering section, advances to director of instruments research and development.

Carolyn Rusch, manager of the Vector Network Analyzer Engineering section, advances to director of systems research and development.



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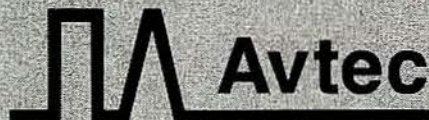
Utilities, airlines, railroads, public-safety, military and other government agencies worldwide have come to rely on Avtec for advanced, high-capacity console solutions for integrated radio/telephone systems. DSPatch is a color touch-screen console system that employs Digital Signal Processors (DSP's) at every line and workstation. Its distributed architecture ensures instant responses, even in large systems. DSPatch may be configured to support from 32 to 1,024 external lines or operator workstations.

FEATURES INCLUDE:

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- ◆ Conventional or trunked radio
- ◆ ANI with call queue
- ◆ Multi-format paging
- ◆ Simultaneous conferences
- ◆ Many more

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Circle (61) on Fast Fact Card

Color catalog displays antennas

A 200-page, fully illustrated antenna catalog from Maxrad presents the company's complete line of base station, mobile and portable antennas, accessories and mounting items for amateur, cellular, data, GPS, land mobile, marine, PCS and SMR applications. New items appearing in the book include antennas for 2.4GHz spread-spectrum data. Customer research was extensively used in creating the catalog so readers can locate and compare products.

Circle (351) on Fast Fact Card

Catalog features coaxial connectors

RF Connectors' 100-page catalog features a full range of standard and RF custom coaxial connectors, including 300 new items and extensive coverage of BNC, TNC, N, UHF, mini-UHF, MB, SMB, SMA, MCX, 7/16 DIN, FMR, LMR series and 1 1/8", 1 1/4", 1/2" and 7/8" corrugated cable connectors that fit Andrew, Cablewave and Eupen cables. The catalog includes more than 1,500 coax products, including cable assemblies, connector kits, Unidapt and Celludapt universal adapter products, cellular products and hand tools.

Circle (352) on Fast Fact Card

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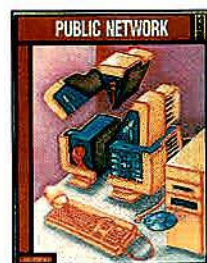


U.S. Patents 5,444,433 - 5,574,999 - D,377,795

Circle (63) on Fast Fact Card

Book examines public communications systems

Intertec Publishing's book, *Public Network Basics*, by Jack Dempsey, examines public communications systems from voice to data, discussing how they work and their potential. The



book details how public networking has advanced from simply a telephone at each end of the line with a switching system in the middle to advanced technology such as digital cellular, digital signaling and wireless local distribution. The book thoroughly discusses today's vastly expanded networks, covering switching, voice and data transmission, and PBX systems. It also delves into tomorrow's technology, including Internet capabilities, PCS and enhanced station equipment and services.

Circle (353) on Fast Fact Card

Catalog available on CD-ROM

Andrew's full product catalog, number 37, comes in printed and CD-ROM versions. Catalog 37 is a complete reference document of Andrew products and services. New sections include Andrew Institute technology training, wireless accessory products, wireless RF active products and base station antennas. The CD-ROM version has expanded search tools to help users find products. Video and animation clips enhance the written text. There is also a direct link to Andrew's Web site, which is updated daily with corporate, product and investor news. The 784-page, color catalog is for systems planners and product specifiers in the electronic communications industry.

Circle (354) on Fast Fact Card

IMTA publication offers information on finding capital

The International Mobile Telecommunications Association's publication, *Financial Resources: Funding Options for Commercial Trunked Radio Systems*, informs current or potential commercial trunked radio operators of where they can go to obtain the capital they need to operate their businesses. This 100-page publication is divided into five major sections, covering every potential funding source, including government financing, equity financing, private debt financing, asset-backed financing and additional resources.

Circle (355) on Fast Fact Card



Mobile Radio Technology

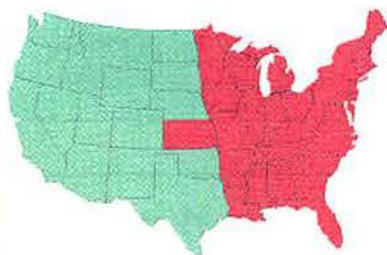
Technical information for paging, SMR and private wireless networks

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Letters

GWEC information:

I was reading about the Global Wireless Education Consortium (GWEC) in the August 1997 "News" section, and after looking back over the article several times, I realized that the article gave no information on how to contact the GWEC. So my question is how can someone reach the GWEC? If you could pass that information along in a future issue of *MRT*, I, and perhaps some other readers, would appreciate it.

John Niles
Maintenance engineer
360° Communications
Cedar Rapids, IA

The Global Wireless Education Consortium's (GWEC) address:

Misty C. Baker
Executive director
GWEC
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Electronic design:

A great part of my time is concentrated on learning all about new technologies. I would like to hear from people and companies, whether public or involved in the natural evolution of paging technology from the beginning to voice, numeric and alphanumeric, and "graphic" paging, capable of displaying email, fax messages and graphic information on dedicated pager units.

Carlos Bolanos
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Letters continue on page 56

Express yourself

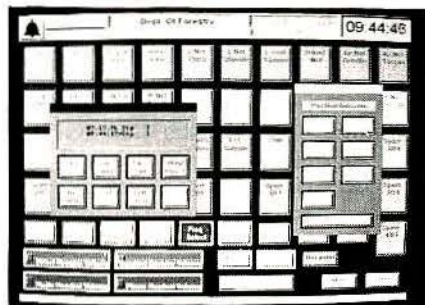
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Need help that other readers might provide?

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Letters from readers

Open letter to the specialized mobile radio industry:

The release of the long-awaited 800MHz Report and Order unshackles an industry restricted by more than three years of license freezes. The impact of the 800MHz proceeding has been dramatic on PCIA's Specialized Mobile Radio Alliance (SMRA) council members, who have spent hundreds of hours debating and working on this item.

Now that the full text of the new Report and Order has been released, the 800MHz industry has an important question to ask itself: Are the new rules workable? In fact, it may not make much difference how the commission decides to license the "white space" if one accepts the notions that: (1) all of the valuable spectrum already is licensed; (2) the new rules permitting incumbent modifications are acceptable as long as the original contour is not exceeded (22dBu for the Upper 200 channels, 18dBu for the Lower 80 and General Category channels); (3) Upper 200 channel incumbents cannot be moved to lower channels without truly equivalent spectrum, and the change will be at the auction winner's expense; and (4) the auction winner must protect the incumbent from interference.

Once this question has been answered,

issues involving the minutia of the order must be addressed. For instance, the auction rules do not include adequate anti-speculator protections, nor do the rules address how an incumbent subject to mandatory relocation will be compensated while its network goes "dark" during the auction winner's modification of the system. The order also fails to explain whether the licensed ERP, or the maximum allowed ERP, should be used in calculating the existing contour.

SMR industry leaders are in agreement that the order should be challenged at the commission and not in court. The FCC has covered its bases in this order, and it is unlikely that a court will vacate part or all of the order, since courts give considerable deference to agency rulings. A court challenge will merely impose additional unnecessary delays in the implementation of viable business plans that have been held in abeyance for years. Even if the industry were successful in court, the FCC would then have to conduct yet another rulemaking proceeding, resulting in even more delays for the SMR industry. All these considerations do not even touch upon the high cost of any litigation, and even after spending the con-

siderable time and resources required to litigate, the industry may still be without new rules for many years.

PCIA and its SMRA members look forward to working with the industry and the commission to create implementation rules and guidelines that will best serve the SMR industry as we move forward.

Jay Kitchen
President

Personal Communications Industry
Association



Readers turn into writers for various reasons:

- To be helpful to other readers.
- To win recognition in their own companies and industry segments.
- To publicize the development of a product or service by detailing the technology involved.

For information on how to submit an article to *MRT*, write or call:

David Keckler, Features Editor
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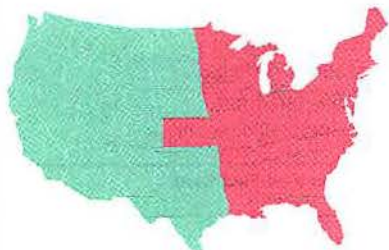
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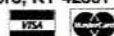
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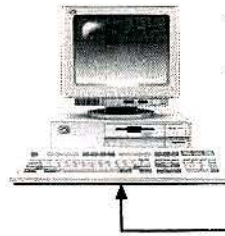
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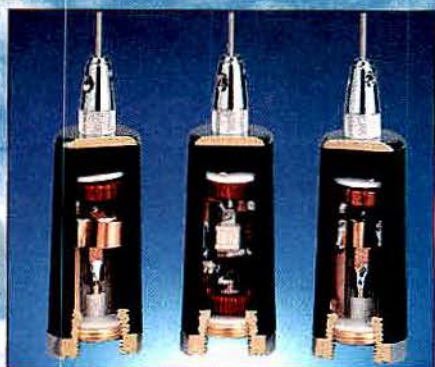
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Equipment For Sale



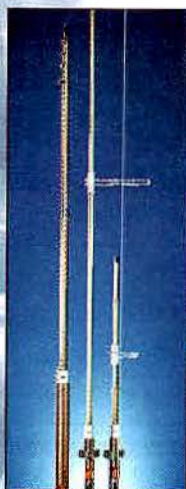
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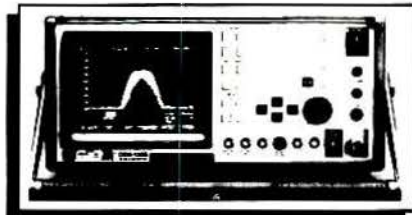
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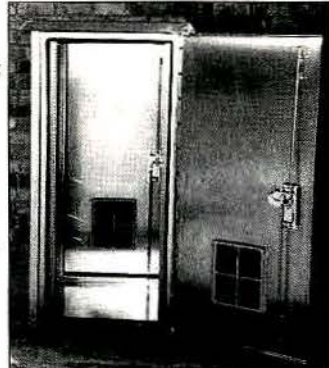
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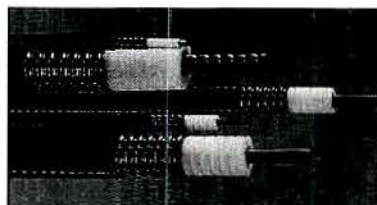
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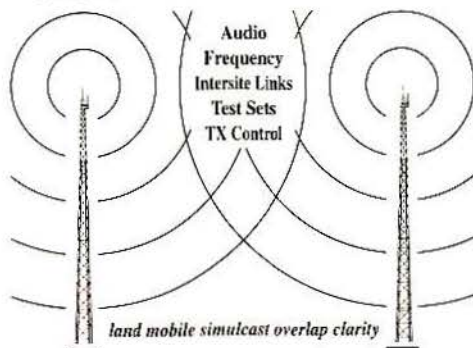
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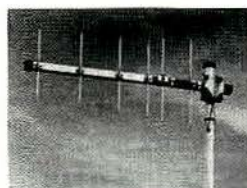
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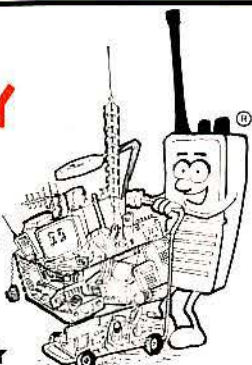
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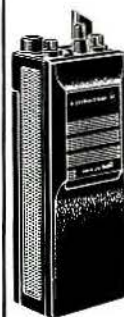


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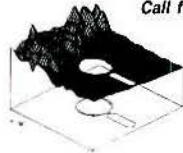
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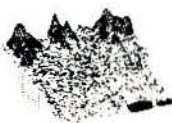
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